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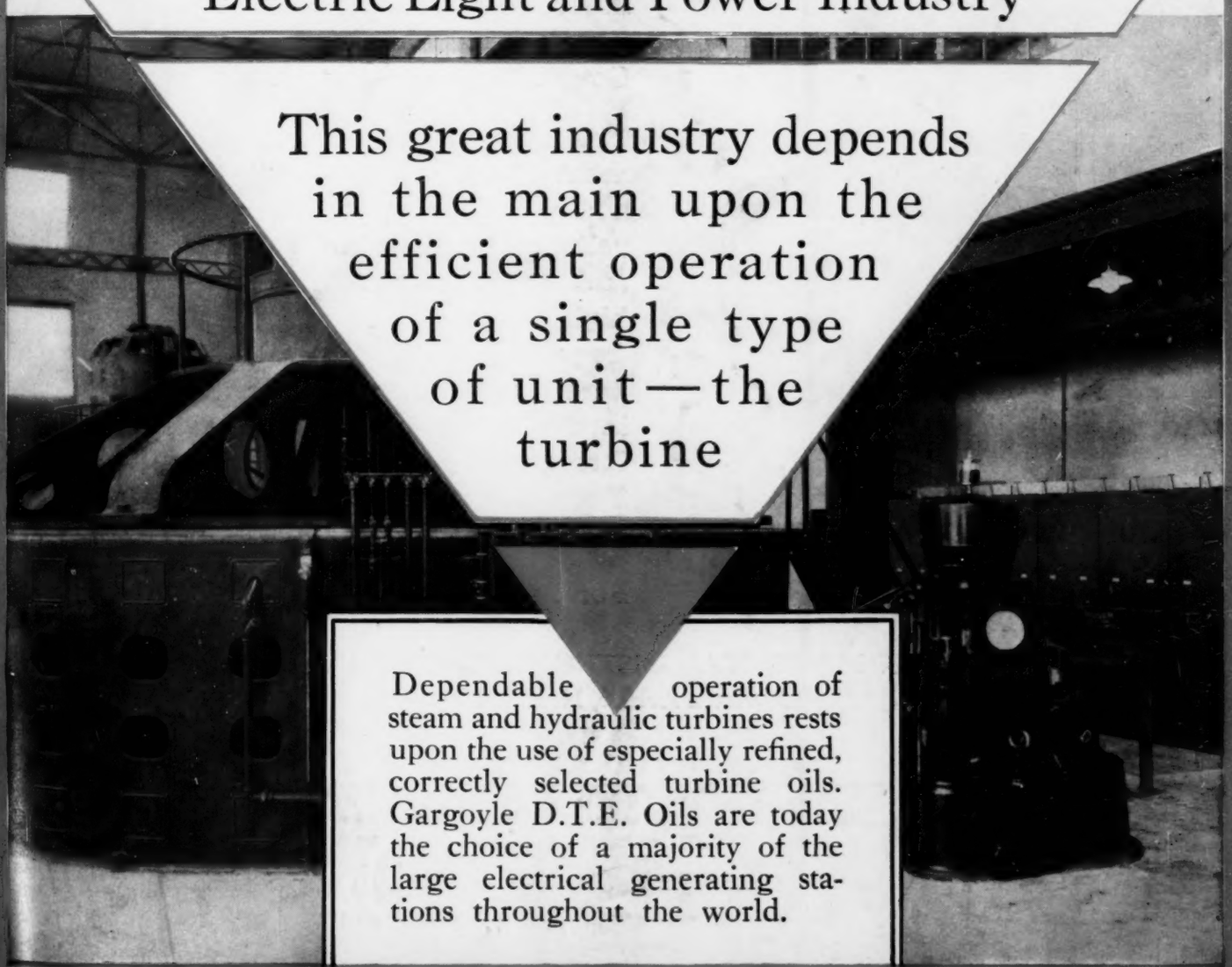

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Vol. 90, No. 1 New York, July 2, 1927 Pages 1-52

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The consolidation of Electrical World, Electrical Engineer and American Electrician

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McGRAW-HILL PUBLISHING COMPANY, INC., Tenth Ave. at 36th St., NEW YORK, N. Y.

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Electrica, Vest *(Published in San Francisco)*
American Machinist—European Edition *(Published in London)*

Member Audit Bureau of Circulations
Member Associated Business Papers, Inc.
Circulation of this issue, 19,425

The annual subscription rate is $5 in the United States, Canada, Mexico, Alaska, Hawaii, Philippines, Porto Rico, Canal Zone, Honduras, Cuba, Nicaragua, Peru, Colombia, Bolivia, Dominican Republic, Panama, El Salvador, Argentina, Brazil, Spain, Uruguay, Costa Rica, Ecuador, Guatemala, Haiti and Paraguay. Extra foreign postage, $4 (total $9 or 38 shillings). Subscriptions may be sent to the New York office or to the London office. Single copies, postage prepaid to any part of the world, 25 cents.
Change of Address—When change of address is ordered the *new* and the *old* address must be given. Notice must be received at least ten days before the change takes place.

Copyright, 1927, by McGraw-Hill Publishing Company, Inc.

Published weekly

Entered as second-class matter Jan. 20, 1907, at the Post Office at New York, N. Y., under the Act of March 3, 1879.
Printed in U. S. A.

Advertising Index—Alphabetical, 116; Classified, 110, 112, 114; Directory of Engineers, 60, 61; Searchlight Section, 62-67

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VOLUME 90 — *New York, Saturday, July 2, 1927* — NUMBER 1

First Half Year's Financing Exceeds That of Last Year

ELECTRIC light and power public utility financing during the first half of 1927 exceeded that of the corresponding period last year by more than 9 per cent. The total for the six-month period was $792,700,000, against $725,800,000 for the corresponding period of last year. During the first few months an exceedingly favorable market encouraged financing on a large scale, and the first quarter's total showed an increase of 47 per cent over that recorded for the first quarter of 1926. In the second quarter the rush of many corporations—industrial and others—into the market created a glut in senior obligations, and some large industrial issues were said to have remained undigested for some time. Despite this condition, the total of light and power financing is now well over 9 per cent above last year's, and the present favorable market portends heavy financing for the second half of the year. Energy sales continue good, and electrical construction must keep pace with business growth.

It is interesting to note the diminishing yield rate of the utility securities. During nine months of 1926 the average rate of return yielded the investor was over 5.50 per cent, and a 6.10 per cent mark was reached in February. It has cost the industry considerably less to carry on its financing during the current year, when yields have ranged from 5.19 per cent to a high mark of 5.69 per cent. These figures indicate that the light and power industry has established a credit position on the money markets second to that of no other industry.

Engineering Developments Surveyed at Institute Summer Convention

ENGINEERS in the electrical industry are optimistic. They have glanced over all aspects of their art and have recorded great progress and, in addition, have outlined definite things which they expect to accomplish in the near future. This status of engineering was indicated at the noteworthy convention of the American Institute of Electrical Engineers held in Detroit last week. It is a notable occasion when more than twelve hundred electrical engineers gather under the auspices of their professional society. Their work is fundamental to industry progress, and the industry may well be proud of the Institute and its accomplishments. It could commendably do more to encourage Institute activities, for the opinions and contributions of professional engineers are worthy of unstinted support and encouragement.

At the Detroit convention a series of technical committee reports were presented which were of great value and importance. Every phase of the art was surveyed carefully and many new developments in equipment and theory were recorded. In addition, sound engineering opinions and suggestions were presented in the reports which deserve serious consideration by all branches of the industry. For example, attention was called to the rapid trend of research away from the colleges to industry, and the engineers consider this not entirely good for the colleges, for the art or for industry. Definite suggestions for needed dielectric researches and similar proposals regarding cognate matters were made. On the whole, these committee reports indicated very satisfactory conditions in engineering and research.

Some unusually good papers and symposiums were included in the program. Catenary construction for railroad electrification, television, dielectric theories and tests, standardization and insulation were subjects for able papers and active discussions. It is to be hoped that the Institute will keep this breadth and diversity in its convention programs so that all electrical engineers will continue to be interested in its activities. A unity, an enthusiasm and a family spirit have been manifested at the recent Institute conventions which speak well for the healthy condition of this large society of professional engineers. In this respect the Detroit meeting was outstanding, and all who attended voted it a great success.

International Standardization Situation Clarified

THE United States National Committee of the International Electrotechnical Commission is now ready to function broadly on international standardization. At the Detroit convention the American Institute of Electrical Engineers approved proposed amendments to the constitution, and other interested organizations had previously agreed upon the new plan of operation. The International Electrotechnical Commission when it visited this country last year broadened its scope of operation along lines which would permit it to discuss and act upon all international standards. It had done such a good job for international electrical standards that its competency was granted, and it showed a broad-visioned and unselfish desire to expand its work and operate as a broad-coverage international standards organization.

It was in conformity with this plan and policy that an able committee of American engineers proposed changes in the constitution of the United States National Committee. It will consist of representatives of six organizations, will be organized to function effectively and will work in a co-operative and definite way with the American Engineering Standards Committee and other standardizing agencies. International standardization is at the discussion stage only, but it is a splendid idea to focus in the United States committee all groups which may be interested in the subject.

V.B.

Unity, decision and breadth should now characterize international standardization procedure in so far as this country is concerned.

The action of all the standards-making groups in industry in agreeing upon the changes and policies for international standardization is a landmark in American standardization. For the first time petty individual jealousies, ancient traditions and professional society ambitions were subordinated to a functional objective which called for vision and unselfish co-operation. Let it be hoped that this spirit will prevail in future with respect to the national standards situation. Let it be hoped also that the electrical men will go forward and make the plan which will be accepted as the best for the electrical industry and for all industry standardization. They have the experience and the vision and should take advantage of their opportunity to contribute greatly to the clarification of the American standardization situation.

A Real Function for the Geographic Sections

IF ANY doubt exist concerning the interest of the electric light and power industry in association affairs or the growing popularity and importance of geographic sections, the Santa Cruz and Salt Lake City meetings of the Pacific Coast Electrical Association and the Northwest Electric Light and Power Association ought to dispel it. By years of effort these geographic divisions of the National Electric Light Association have been welded into coherent, self-sustaining and enterprising entities, capable and eager to carry on sectionally such work as falls within their province and to contribute their experience, skill and observation to the national program. Having "arrived," so to speak, greater attention must now be given to program, or these young giants will dissipate their strength in minor performances.

Right now the threatened encroachments of government in the power business in California, Oregon and Washington give purpose and zest to the activities of these Far Western sections, but interest in purely political questions affecting the industry, important as these are, cannot be maintained at white heat. The economic aspects of the electric light and power business need greater elucidation and simplification, particularly those phases of the business dealing with water-power development and the wider market which must be built up to absorb the power. Besides this, the rapidity with which steam-station performance is overtaking and in many instances outdistancing water-power performance should be broadcast for the information and guidance of the people in the Far Western and Rocky Mountain States. Otherwise, by placing too much faith in the superiority of their water powers and insisting on their development, they may be led to do the public utility companies a gross injustice. It is not right for citizens to be permitted to live in a fools' paradise because of lack of knowledge about a purely technical and economic question. It is in this direction that much work still remains to be done. The geographic divisions in question are already beginning to recognize this fact, and doubtless the larger questions involved will gradually push themselves forward. Such work the geographic sections are eminently qualified to undertake.

Follow Through on the Hurley Award!

IF THE Hurley award is to have the value to the power industry that the donor of the ten thousand dollars intended and the sales managers of the power companies expected, the prize-winning reports should be printed and distributed broadly. Without this little will have been accomplished. For the mere gratifying of fortunate contestants is not alone worth $10,000.

Prize award contests of this kind are fine contributions to the progress of the electrical industry, but not infrequently most of the value is lost because with the awarding of the prize men turn to something else and the educational value of the achievement is not applied. In this case, E. N. Hurley offered these prizes to those companies that submitted records of the best sales methods successfully applied in central-station merchandising. It was his belief that the methods so rewarded would be studied by the entire industry and widely adopted. But if these reports are merely announced in the electrical press and published in the *N.E.L.A. Bulletin*, their influence will largely die a-borning.

For unless they are distributed in convenient form, so that they can be carried around, studied and discussed by many members of an organization and then held on file, the stress of the day's work will crowd them out and a great opportunity will be lost. They need not be published in expensive form, but they should be made available in generous number. And the printed report should carry a statement from the judges pointing out the strong points of each plan, and the weak points too if there be any.

Significance of the Radio Trade Show to Electrical Men

THE recent trade show and convention of the Radio Manufacturers' Association in Chicago has opened the eyes of many electrical men to the astonishing growth of the radio industry. In the neighborhood of 18,000 people attended this gathering. These were radio dealers, jobbers and manufacturers interested in the new development of the art as presented by the 259 exhibitors who participated in the trade show. Nearly 2,200 men and women sat down at the banquet which marked the last day of the convention. It is estimated that approximately $500,000 was spent on the affair by this great throng. What does it mean?

It means that radio—the youngest child of electricity—is no longer just a branch of the electrical industry. It has become a great allied industry, largely independent in its production and its distribution and in many ways as much an industry apart as the telephone industry and the street-railway industry are separate, although all are clearly electrical in origin and nature. Yet it is an industry that is clearly trending toward a more and more intimate relationship with the power industry, inasmuch as battery power is gradually giving way to the use of energy taken directly from central-station circuits. The bond between the organized electrical industry and the organized radio industry, therefore, must continue increasingly close and strong.

At the present time there are two associations of manufacturers functioning in the radio industry. The

Radio Division of the National Electrical Manufacturers' Association has a small but important membership and has made its contribution in the field of standardization. The R.M.A. has a large and more embracive membership and has done its work mainly along the lines of market development. There has been much competition between them, but time will straighten out this tangle. The scope and importance which radio has now attained as an industry, however, as evidenced by the exhibition and the outpouring in Chicago, has registered one impression pre-eminently, and that is the urgent necessity for a close co-ordination between the national associations of the electrical industry and the national associations of the radio industry. It is vital that all the great major associations of the electrical industry recognize now the vast importance which radio has assumed in the country and establish frank relationships that will protect the common interests involved.

The radio industry will continue to increase with the years and should have the sympathetic co-operation of every electrical man. Much of the future market building will have to be done together, for radio is fast becoming a very profitable energy-consuming appliance.

Questioning the Quality of North Skylight

A PROPITIOUS stage in the development of artificial light has been reached for exploding the tradition that north skylight is the best quality of light for the discrimination of color. Many centuries ago, when artificial light was entirely unsuitable for color work, the artist and the artisan interested in color went to the north window because the least variable daylight comes from the northern sky. Throughout the centuries which followed others working with color gravitated to north light, so that a powerful tradition has been established to the effect that north skylight is best for color work. But it has been generally forgotten why north light was originally chosen. It was not primarily for its "color value," but because it was less variable in quantity and in quality than light from any other exposure.

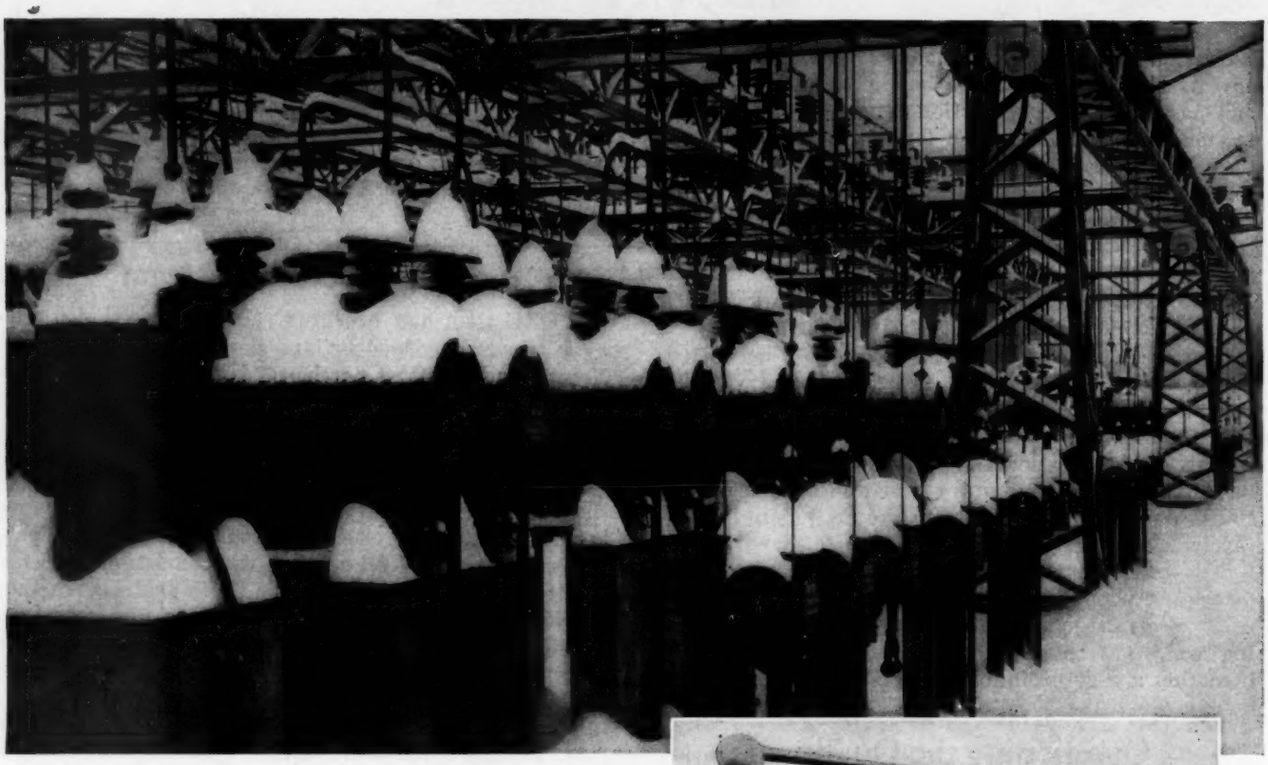
In recent years the efficiency of light production has increased so greatly that it is now practicable to produce artificial daylight of any quality desired. A great deal of color work is now done throughout any hour of the day or night by means of artificial daylight which is constant in quantity and in quality. In this respect artificial daylight is now very much more satisfactory than even north skylight, and it also compares favorably in cost.

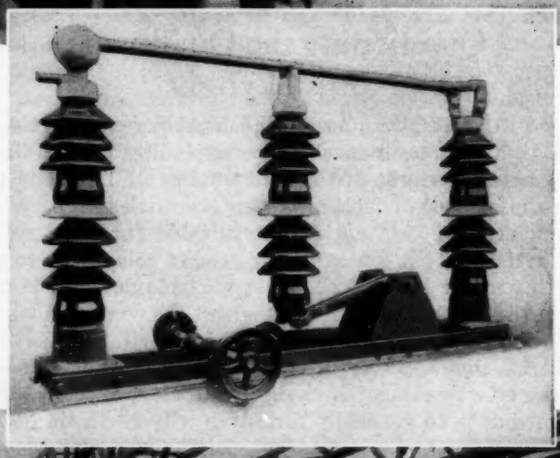
Those who developed artificial daylight found it necessary to supply a quality of light simulating north skylight because of the firmly intrenched habit of using north skylight for color work. Certainly, an illuminant to be most suitable for color work should be one that merely "reveals" the colors instead of "coloring" them. The only illuminant that is "neutral" in this respect is a white light, and spectrally this is very near to noon sunlight on a clear day. North light from a clear sky is decidedly bluish. It very much favors the violet, blue and green components of colors. It makes the purples (pink, lavender, magenta, etc.) much more bluish in appearance than they are under a neutral white light. It dulls the yellow, orange and red components. From a scientific viewpoint white light of a "black-body" energy distribution, such as the noon sun at about its apparent color temperature, is the ideal illuminant for general color work. Thousands of artificial daylight units and millions of tungsten "daylight" lamps are now in use. Their value will be better understood if light users rid themselves of the "north-light habit."

A Tin Peddler's Dream

MORE than half a century ago a wagon laden with tinware plodded up and down the hilly roads of New Hampshire and northern Massachusetts, stopping at farms and villages to exchange its humble freight for the hard-won cash of housewives and slowly accumulating for its driver a store of wealth which by thrift and employment of others reached an amazing total as the years unrolled. As the long miles were covered there was time for reflection by this man of few advantages, and as his life went on the conviction deepened that to education of a new type the industrial era then developing must look for wise guidance and sound expansion. John Boynton became a manufacturer and man of affairs through the successful distribution of his products, and in 1865 he made known his desire to appropriate $100,000 for the founding of an institution "to send forth useful citizens, not only well versed in the sciences and arts, but also persons of good morals who will lead upright and honest lives in the sight of God and man." So came into being the Worcester Polytechnic Institute, one of the pioneer schools of engineering in this country in which theoretical and practical training were effectively combined to produce a well-rounded education in applied science, and an institution of the highest repute from its opening day to this.

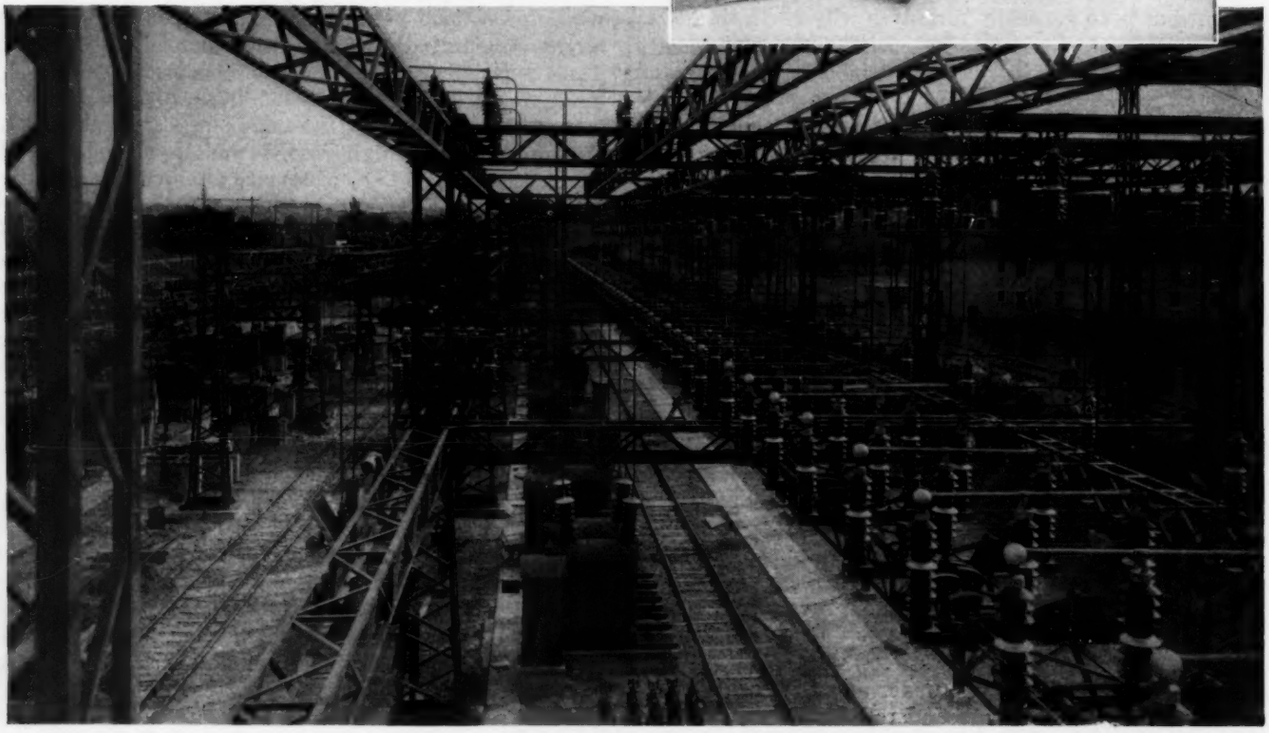
Last week a bronze tablet set into a granite boulder was dedicated on the village green at Mason, N. H., to the memory of this unostentatious merchant whose vision ran so far beyond the horizon of his time and whose privations but stimulated his resolve that others might walk in paths of knowledge denied his own feet. The tin peddler's dream has materialized in a development in engineering education inconceivable from the seat of his long-vanished cart, and successive generations of young men of high resolve and ingrained purpose have entered upon lives of service from this and similar institutions with credit to the principles upon which their training has been founded and carried on. It is easy to overemphasize picturesque beginnings in surveying splendid maturity, but what instrument can measure the value of a new idea inclosing the germ plasm of unlimited development? Again and again America illustrates the growth of superb enterprises from conceptions realized by humble minds in unexpected places. The history of education is crammed with tributes to the indomitable spirit of mankind, which rises to every challenge of difficulty and reaches out for truth that life may be enriched for all. The engineering profession does well to recognize its debt to the founders of its schools. Its members have kept the faith of science amid mighty changes and great material temptations since the far-off days of Boynton and his contemporaries, and who can doubt that the seeds planted by these pioneers and nourished by equally noble gifts from their successors will bear fruit in glorious service to men so long as our civilization shall endure?





Railway Electrification in Switzerland

THE Seebach outdoor switching station, shown here, represents one of the more recent types of outdoor substations being built by the Swiss Federal Railways. Single-phase energy generated at 15 kv. in hydro-electric plants is stepped up to 60 kv. and transmitted at this potential to substations distributed along the railway lines. At these stations it is again transformed to 15 kv. The oil circuit breakers for the 60-kv. lines and transformer circuits are rated at 80 kv., 200 amp. and a breaking duty of 450,000 kva. No special lightning arrester apparatus is provided for either the 15-kv. or the 60-kv. lines and so far no serious difficulties have been reported due to the omission of this equipment. The illustrations and information were furnished by M. Barrère, Paris.



Standardization Policy Outlined*

The Place of the Institute in the Making of National and International Standards—Should Carry On Until National and International Status Is Improved

By Cummings C. Chesney
President American Institute of Electrical Engineers

THE recent great activity in standardization, which is now so generally recognized, is, in my opinion, largely the direct outcome of the scarcity of labor since the Great War and the passage of our new immigration law and the laudable desire to maintain and extend the high standard of living that has existed in this country for the past quarter of a century.

All this argues for the maintenance and increase of the present earnings of the worker and at the same time requires the lowering of the cost of production. Standardization, which permits more readily repetitive methods of production, stimulates the invention of machines to do more rapid, accurate and skilled work.

Standardization and mass production contribute to decreased cost, not only through the economies effected in the manufacture of the product but also in the economies effected:

1. In calculations and designs.
2. In the preparation of drawings and specifications.
3. In making propositions in response to request from customers.
4. In selling costs.

In the Institute standards committee, or in its subcommittees, the manufacturer and purchaser and the general interests came together and developed the required standards in a way that has been generally satisfactory in the past to all the interested sections of the industry. The electrical standards so issued always have been identified with the name of the Institute. It is well known that the Institute as an organization has no interest other than one of public service, which duty the Institute has always performed at its own expense. The Institute in performing this service, although voluntary, has assumed obligations during the past 28 years to the electrical industry and the public which would make it now embarrassing, if not impossible, to discontinue the present practice or lessen its responsibilities until a more simple and direct method has been devised and demonstrated.

In 1916 the need for a national clearing house for engineering standards became apparent, in order to prevent duplication in standardization work and in promulgation of conflicting standards. To formulate a method of co-operation a special joint committee, made up of representatives from the American Institute of Electrical Engineers, the American Institute of Mining Engineers, the American Society of Civil Engineers, the American Society of Mechanical Engineers and the American Society for Testing Materials, held its first meeting Jan. 17, 1917. The result of this meeting and subsequent meetings was the organization of the American Engineering Standards Committee. This committee initially consisted of representatives of these five institutions. Shortly after its organization government representatives were admitted, and in 1919 the constitution was broadened to permit representation from other national bodies. The committee now includes representatives from seven departments of the federal government, nine national engineering societies and nineteen national industrial associations.

The American Engineering Standards Committee as at present organized is a co-ordinating committee and not a standards-making body. All standards are to be formulated and published by the respective societies making the standard—this intention is clearly expressed in the constitution, and the American Engineering Standards Committee is, moreover, primarily an administrative and policy-forming committee—a function of great value and scope to industry.

A.E.S.C. Has Financial Handicap

As stated by its secretary, perhaps the most important accomplishment of the American Engineering Standards Committee has been the actual launching of the work, setting up machinery and securing the official co-operation of about 300 national organizations—that is, the fundamental job of breaking ground. Ninety-seven standards have been approved for the engineering and building trades—ten have to do with the electrical industry. In my opinion this is a very excellent record of accomplishment to date. The secretary also states that every one who has examined the work before the American Engineering Standards Committee agrees that the whole movement of making American standards is being seriously crippled by the lack of adequate financial support. The total annual budget is $58,000. The American Institute of Electrical Engineers as such contributes to the American Engineering Standards Committee $1,500 annually. Due to legal restrictions, the government departments are unable to pay dues, and a special provision is made exempting them from such payments.

The secretary also expresses the opinion that inertia, lack of interest and understanding of the standardization method as a whole and of its economic relations to their business on the part of executives and industrial groups, has been one of the greatest difficulties encountered in the successful accomplishment of the committee's work. It is now proposed, by the process of amendment, to make a material and fundamental change in the constitution of the American Engineering Standards Committee. This can be done only by unanimous consent, notwithstanding the general provision in the constitution providing for its amendment by a lesser

*Abstract of presidential address at Detroit convention, June 21, 1927.

vote. Such provisions apply only to incidental amendments made to carry out the purpose of the organization, and not to fundamental changes; any amendment that aims to convert the American Engineering Standards Committee into a standards-making body or into a body that would interfere in the autonomy, in standardization work, of the representative societies would be unconstitutional.

On Feb. 9, 1926, during Dr. Pupin's administration, the board of directors authorized a brief statement of its policy to its representatives on committees, or on joint bodies, dealing with the formulation of standards:

1. To continue to develop, publish and maintain in the name of the Institute electrical standards as it has done for the past 25 years.
2. That in doing this work the Institute will continue, as it has in the past, to avail itself to the fullest degree of the assistance of others, both individuals and organizations, with a view to serving the interests of all who may be properly concerned in the work.
3. That standards, after having been developed by the Institute in accordance with 1 and 2 and adopted by the board of directors as Institute standards, will be, when in the opinion of the institute such a step is proper, presented to the American Engineering Standards Committee for approval by it as American standards.
4. That such presentation to the American Engineering Standards Committee for its consideration for approval as American standards will be done in full conformity with the constitution, bylaws and rules of procedure of the American Engineering Standards Committee, which committee the Institute was instrumental in initiating and has continued to and does now indorse and support.
5. That when and if standards of the A.I.E.E. have been further advanced to the stage of being designated as "approved as American standards by the American Engineering Standards Committee," they shall continue to be printed as standards of the A.I.E.E. with a statement of approval by the American Engineering Standards Committee added to the title page of each particular standard.

This statement I understand to mean that the American Institute of Electrical Engineers is in sympathy with the American Engineering Standards Committee as it is now organized, but that any changes affecting the fundamental character of the committee may not be acceptable to it.

International Standardization

Somewhat over a year ago a movement to form an International Standards Association was undertaken, the proposed organization to have a national committee in each country. In America the national committee was to be the American Engineering Standards Committee. As it has been stated heretofore, its (A.E.S.C.) principal constitutional object is to supervise standardization work, but it is expressly stated in its constitution that it shall not formulate standards. There is, however, a clause in its constitution that states that one of the objects of the American Engineering Standards Committee shall be "to act as the authoritative channel of co-operation in international engineering standardization."

The Institute has subscribed to the American Engineering Standards Committee constitution. It is also a member of the United States National Committee of the International Electrotechnical Commission, which has been and is at present the body through which the electrical industry of America is conducting its international standardization work. The Institute is thus faced with a conflict of obligations. The most reasonable course is for it to go before the American Engineering Standards Committee with a frank statement of the case and ask the American Engineering Standards Committee for its support for the course which the Institute considers to be in the best interest of the electrical industry of this country at the present time. Under the procedure of the International Electrotechnical Commission much of value has been accomplished in establishing international electrical engineering standards. This field alone is a very large one, and it would appear unwise to abandon the present successful plan for the untried plan of an International Standards Association which does not appear to be based on such sound fundamental principles.

Advocates No Change in Electrotechnical Commission

The success of the International Electrotechnical Commission has been so considerable that it could well be duplicated in other engineering fields, such as mechanical, civil and mining fields, etc. If this were done, we should, in addition to the International Electrotechnical Commission, have an International Mechanical Commission, and International Civil Commission, etc. At some future time it might become desirable to tie these international organizations into an international technical commission, but it would at this time be premature to try to decide whether this last step would be desirable and when it should be undertaken.

It would appear that if the electrical industry is a unit in desiring to continue the International Electrotechnical Commission and in believing that its interests would be seriously endangered by going over to a new plan, representations to this effect should be made in proper form and on the proper occasion to the American Engineering Standards Committee. While the International Electrotechnical Commission recognizes that its field is electrical and that the desired international accomplishments in that field also constitute an enormous task, it is also recognized that its twenty years of experience constitutes a considerable asset. The International Electrotechnical Commission has never taken advantage of this asset in a selfish way. In cases where, in other fields of engineering, it should be desired to make use of the International Electrotechnical Commission's organization and experience, either temporarily or permanently, for work in other lines, the International Electrotechnical Commission is prepared, as in certain cases in the past, to offer its facilities and to adapt them to include the added work. In such cases the International Electrotechnical Commission could arrange with the organization in whose field the work belongs for additional representatives from that organization's membership. If at a later time the co-operating organization, through the establishment of its own international organization or from any other reason for change of policy, should decide to discontinue the arrangement, this without doubt should and would meet with the hearty agreement of the International Electrotechnical Commission.

Three open problems on standardization thus confront the institute and their importance justifies a prompt solution, but not a hasty one.

1. The internal routine to be followed through its committee on standards for the handling of standards and standardization should be revised. This has to do primarily with the A.I.E.E. standards.

2. The present and future status of the American Engineering Standards Committee should be determined.

3. The relation of the American Institute of Electrical Engineers to the United States National Committee of the International Electrotechnical Commission.

DETROIT WAS THE MEETING PLACE OF ELECTRICAL ENGINEERS FROM ALL OVER THE COUNTRY LAST WEEK

A.I.E.E. Holds Well-Balanced Convention

Directors Join Hands with Other Organizations in Adopting Constructive Plan for Handling Standards—Technical Papers and Reports Have Broad Appeal—Discussions Reported

FOR breadth of appeal, excellence of papers and reports and opportunity afforded to exchange ideas, the summer convention of the American Institute of Electrical Engineers, held at Detroit June 20 to 24, could hardly be excelled. It was noteworthy, besides, in that the action of the board of directors has completed the indorsement by major electrical organizations of a plan for international standards.

More than 40 technical papers and reports were presented, touching nearly all phases of electrical activity. Afternoons and evenings were free of business sessions and available for informal exchanges of experience or social events and outdoor sports. As the titles of the papers and reports will indicate, there was something alike for utility engineers (whether interested in generation or transmission), communication engineers, research men and those interested in railroad electrification. Two papers—one on station auxiliary drives and the other on arc phenomena—will be presented quite fully later.

Following are the "high lights" of the remaining papers and discussions. Attention is directed particularly to the abstracts on co-ordinating hydro and steam plant operation, transmission-line performance, ground-relay protection, committee reports on power generation and protective devices, high-voltage cable joints, investigations of corona loss, and puncture voltage as a precision measurement.

Important Operating Problems Considered

"Recent Investigations of Transmission Line Reliability."
By J. G. HEMSTREET, Consumers Power Company.

"Ground Relay Protection for Transmission Systems."
By B. M. JONES and G. B. DODDS, Duquesne Light Company.

"Directional Ground-Relay Protection."
By J. B. BREISKY of the Westinghouse Electric & Manufacturing Company and G. W. KING of the Consumers Power Company.

"Holtwood Steam Plant, Design and Operation in Co-ordination with Water Power."
By F. A. ALLNER, Pennsylvania Water & Power Company.

"Auxiliary Power at Richmond Station."
By J. W. ANDERSON, Philadelphia Electric Company, and A. C. MONTEITH, Westinghouse Electric & Manufacturing Company.

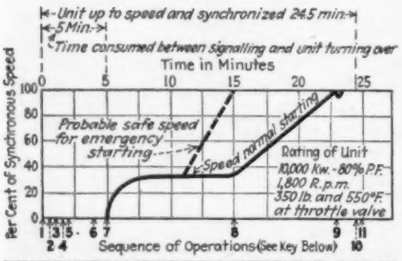
FIVE excellent papers, listed above, were presented at the Tuesday session, the one on auxiliary power by J. W. Anderson and A. C. Monteith will be digested quite fully in a later issue. The remaining papers with their discussions are abstracted here.

The generating equipment at Holtwood consists of two 10,000-kw., 80 per cent power factor, 1,800 r.p.m., three-phase, 60-cycle, 13,200-volt generators driven by nine-stage turbines designed for 350 lb. (23.8 atm.) gage at the throttle, according to F. A. Allner. Initial operation is at 550 deg. F. (287.7 deg. C.), but the turbines are guaranteed to operate successfully at 700 deg. F. (371.7 deg. C.) if the superheat should be increased later. Each unit has a 75-kw., 250-volt shaft-end exciter. Steam is bled from the turbines at three stages—the third, fifth and seventh. Each turbo-generator is equipped with a 13,000-sq.ft. (1,208-sq.m.) single-pass condenser.

The boiler installation consists of three cross-drum vertically baffled three-pass B. & W. boilers, each with a heating surface of 14,056 sq.ft. (1,305.7 sq.m.), exclusive of the water screen at the bottom and back of the furnace, which has an additional surface of 775 sq.ft. (72.0 sq.m.). The working pressure is 385 lb. (26.2 atm.) gage. Each boiler is equipped with a convection type superheater above the top row of water tubes, designed to give a steam temperature of 560 deg. F. (293.3 deg. C.) at 250 per cent rating. Each boiler has its own stack with a height of 126

ft. (38.4 m.) above the burners. There are two induced draft fans above each boiler. Neither economizers nor air preheaters are installed, although provision is made to add such equipment later on, if found advisable. Makeup water is furnished by two horizontal single effect evaporators which are supplied with filtered river water.

The furnaces have air-cooled side and front walls. Each furnace has a volume of 11,500 cu.ft. (325 cu.m.) above the water screen. The vertical burners, of which there are eight to a boiler, are set under the high end of the boiler.


Unit up to speed and synchronized 24.5 min.
5 Min.
Time consumed between signalling and unit turning over
Time in Minutes
Per Cent of Synchronous Speed
Probable safe speed for emergency starting
Speed normal starting
Rating of Unit
10,000 Kw.-80% P.F.
1,800 R.p.m.
350 lb. and 550°F. at throttle valve
Sequence of Operations (See Key Below)

No.	Operations by Engineer	Condenserman	Oiler	Switchboard Operator
1	Signals to condenser room to start condensate and circulating water pumps			Signals to engineer
2	Closes turbine drains and turns water and steam on shaft seals	Starts condensate pump	Opens valve to auxiliary steam line	
3	Starts steam jet air pump	Circulates condensate to tanks		
4	Starts auxiliary oil pump	Starts circulating pump		
5	Turns steam into turbine main			
6	Vents condenser water box and syphons water into tail pipe			
7	Opens throttle valve and brings turbine to ⅓ speed			
8	Brings turbine to speed and puts water on shaft seal, signals switchboard to close generator field circuit breaker			
9	Trips turbine by oil trip and reopens throttle valve			
10				Synchronizes generator
11	Adjusts seal leakoff, turns water on air and oil coolers	Turns condensate into suction header of boiler feed pump		

ANALYSIS OF TIME CONSUMED IN STARTING A 10,000-KW. STEAM UNIT (ALLNER)

Pulverized coal feeders are arranged in four motor-driven pairs per boiler. There are three primary air fans. The boilers are arranged in a single row parallel to the turbine hall, in which the turbines are placed lengthwise. The boilers and furnaces are guaranteed to give 300 per cent rating for 24 hours, or 400 per cent for twelve hours when using bituminous coal, and 250 per cent for 24 hours or 325 per cent for twelve hours using river anthracite.

All auxiliaries are motor driven with the exception of one steam turbine-driven boiler feed pump. Each of the two circulating water pumps has a dual drive consisting of one 25-cycle and one 60-cycle motor. All other alternating-current motors are 60-cycle. The 60-cycle hydro-electric units provide an independent source of power, which is considered of greater reliability than shaft-end auxiliary generators or house turbines. The boilers and furnaces have Bailey automatic combustion controls, which operate the coal feeders, the induced draft fans and the stack dampers.

The chart shows a summary of the cost of the plant, exclusive of property, legal and corporate expenses, housing for employees, interest during construction and exclusive of any contractors' fees. There are several factors which should be borne in mind in comparing these costs with those of other plants. The present boiler installation is larger than needed for the first two turbines, and surplus pulverizing capacity on a bituminous rating was installed to offset partly the reduction in capacity when milling river coal. Switching equipment is installed for two more units and the cable tunnel to the hydro-electric plant will take care of the ultimate station. The intake and discharge tunnels are built for two more units of a capacity up to 35,000 kw. each. The width of the power house is sufficient to accommodate units up to 35,000-kw. capacity and larger boilers.

It may be of interest to note that the cost of the preparation plant per net ton of pulverized output per hour on a bituminous rating was $8,720 for structures and $10,830 for equipment, or a total of $19,550.

Operating Results and Experience

In the calendar year 1926 the gross output of the steam plant was 60,870,000 kw.-hr. The station uses, including coal handling and preparation, amounted to 4,200,000 kw.-hr., or 6.9 per cent, giving a net generation of 56,670,000 kw.-hr. The one-hour peak load was 26,600 kw., or 33 per cent more than the nominal rating of the two units. The annual load factor was 26.1 per cent and the annual capacity factor based on gross generation was 34.8 per cent. The variable character of the plant load is shown by the fact that the highest net output was a little over 10,000,000 kw.-hr. in the month of July, whereas the lowest output was only about 2,500,000 kw.-hr. in the month of October. The year 1926 was one of better than average river flow, which accounts for the relatively low output of the steam plant.

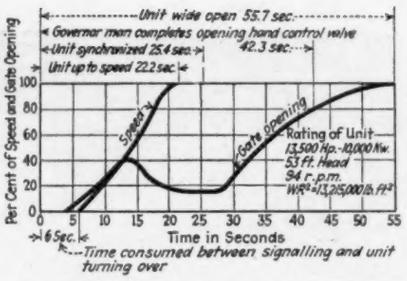
The average economy for the year was 21,160 B.t.u. (5,331 kg.-cal.) per net kilowatt-hour. The best weekly economy reported was 18,350 B.t.u. (4,623 kg.-cal.) per net kilowatt-hour burning 100 per cent bituminous; the best weekly economy burning 100 per cent anthracite was 19,800 B.t.u. (5,010 kg.-cal.) per net kilowatt-hour. The average boiler and furnace efficiency for the year was 79.6 per cent without allowance for drier fuel or for energy requirements of the boiler auxiliaries.

The boilers have operated up to 385 per cent rating for a few hours at a time. The average rating for the total steaming period was 201 per cent.

Of the total coal used, 35.4 per cent was river anthracite and 64.6 per cent bituminous. The average quality of the two fuels was approximately as follows:

	Anthracite	Bituminous
Moisture	13.0 per cent	3.8 per cent
Ash, dry basis	16.7 per cent	11.1 per cent
B.t.u. wet basis (kg.-cal.)	10,880 (6,044)	13,210 (7,339)

The effect of ground resistance on insulator flashovers, the necessity of



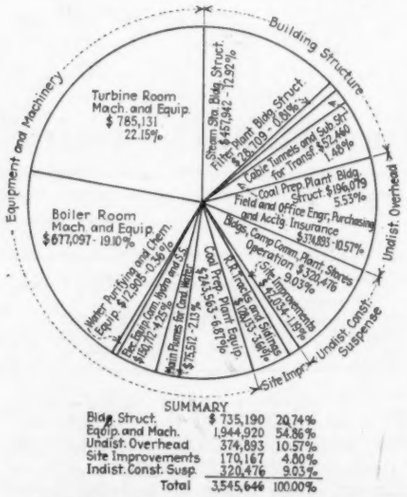
ANALYSIS OF TIME CONSUMED IN STARTING A 10,000-KW. HYDRO UNIT (ALLNER)

protecting insulators from arcs, and the soundness of certain theories and recommendations for increasing transmission reliability, based on laboratory experiments, were considered in the paper by J. G. Hemstreet, who presented his experiences with the 140,000-volt Michigan system chiefly in tables and curves.

The data show that the flashovers on the upper, middle and lower conductors reduce in the order named, flux control reducing the flashovers on the middle and lower conductors compared with sections without this protection. With few exceptions the flashovers are lower where the ground resistance is lower. Results indicate that all three conductors should be in a horizontal plane and at the minimum distance above the effective ground or natural earth-water level.

Contrary to previous belief, flashovers do not increase with mileage of line, apparently because lightning surges travel only a short distance. Arcing horns have reduced flashovers from 66, 38 and 28 per cent on lines not equipped to 3 and 5 per cent on those equipped, while flux controls reduced them to 5.3 and 11.5 per cent. In some instances the top or lower disk is broken by arcs, but there has not been sufficient damage of this kind that it would warrant protection at the top of the string.

Breakdowns at strain insulators have occurred chiefly between jumper loops and tower. In virtually 50 per cent of the cases where no arc production is used the caps of the insulators are burned. The amount of cascading is


Building Structure
Equipment and Machinery
Undist. Overhead
Undist. Const. Suspense
Site Improvements
Turbine Room Mach. and Equip. $ 785,131 22.15%
Boiler Room Mach. and Equip. $677,097 - 19.10%
Steam Stn. Bldg. Struct. $467,942 - 13.19%
Filter Plant Bldg. Struct. $ 78,709 - 2.06%
Cable Tunnels and Sub. Sta. for Transf. $52,460 1.48%
Coal Prep. Plant Bldg. Struct. $196,079 5.53%
Field and Office Engr.; Purchasing and Acctg. Insurance $374,885 - 10.57%
Water Purifying and Chem. Equip. $72,505 - 0.36%
Fac. Adapt. Conn. Spurs and Sw. $168,770 - 4.75%
Main Rooms for Coal Mill $75,512 - 2.13%
Coal Prep. Plant Equip. $243,563 - 6.87%
R.R. Tracks and Sidings $108,133 - 3.05%
Bldgs., Comp. Comm., Plant. Stores Operation, $320,476 - 9.03%
Site Improvements $41,054 - 1.15%

SUMMARY

Bldg. Struct.	$ 735,190	20.74%
Eqdip. and Mach.	1,944,920	54.86%
Undist. Overhead	374,893	10.57%
Site Improvements	170,167	4.80%
Indist. Const. Susp.	320,476	9.03%
Total	3,545,646	100.00%

CONSTRUCTION COST ANALYSIS OF HOLTWOOD STATION (ALLNER)

SUMMARY OF FLASHOVER DATA (HEMSTREET)

Section of Line	Junction-Grand Rapids		Edenville-Saginaw		Saginaw-Flint		Argenta-Battle Creek		Battle Creek-Jackson		Mio-Loud		Loud-Emery Jct.	
Frequency of current, cycles	30		60		60		30		60		60		60	
Length of line—miles	101		40		44		26		43		32		19	
Conductor	110,000 c.-m. Copper		2/0 Copper		3/0 Copper		4/0 A.C.S.R.		2/0 Copper		110,000 c.-m. Copper		110,000 c.-m. Copper	
Number of years in operation	8		2		2		5		5		10		9	
Total number towers	1,057		348		352		270		438		301		188	
Nominal length of span—feet	530		660		660		530		530		530		530	
Average height lowest conductor—feet	31		34		34		32		32		28		28	
Number disks in insulator string—suspension	10		9		9		10		10		10		10	
—strain	12		12		12		12		12		12		12	
Arc protection	None		Flux control		Flux control		15-in. horns		15-in. horns		None		None	
Number suspension strings	2,811		1,020		1,047		843		1,345		738		509	
Number strain strings	744		98		210		132		173		330		110	
Total number strings, insulators	3,555		1,118		1,257		975		1,518		1,068		619	
	No.	Per Cent	No.	Per Cent	No.	Per Cent	No.	Per Cent	No.	Per Cent	No.	Per Cent	No.	Per Cent
Number suspension strings flashed over	486	17.3	34	3.3	56	5.3	73	8.7	75	5.6	43	5.8	27	5.3
Number strain strings flashed over	39	5.2	3	3.1	5	2.4	1	0.8	11	6.4	18	5.5	2	1.8
Total number strings flashed over	525	14.7	37	3.3	61	4.9	74	7.6	86	5.7	61	5.7	29	4.7
Number flashovers, top conductor	217	41	31	84	39	64	40	54	45	51	35	57	16	55
Number flashovers, middle conductor	161	31	5	13	13	21	20	27	25	29	11	18	6	21
Number flashovers, lower conductor	147	28	1	3	9	15	14	19	16	20	15	25	7	24
Number cases of damaged conductor	345	66	2	5.3	7	11.5	2	3	4	5	23	38	7	24
Number flashovers per mile of line per year	0.650		0.461		0.691		0.570		0.405		0.180		0.170	
Failure of line due to burned wire or hardware	3		None		None		None		None		1		None	

not so great where horns are used, varying from 19 to 37 per cent on the disk below the top one. Arcing horns effect a marked decrease in damage to line conductors.

A total of 567 surges between one and one-half and ten times line voltage was observed, 275 being one and one-half times normal voltage. A potential gradient of 30 kv. to 50 kv. per foot of conductor elevation has been checked as measure of lightning-induced voltages. Small arcing horns have a high efficiency in protecting conductors, but undoubtedly lower the flashover of the string. Not much difference in performance was noted between various types of plain horns. The power arc has a strong tendency to blow away from the insulators in most cases, but devices which will prevent cascading are of considerable value.

Among remedial measures being taken by the Consumers Power Company are (a) installation of ground wire on all tower lines; (b) use of arc protections on all lines regardless of whether ground lines are used; (c) consideration of wooden-pole H-frame construction with conductor in a horizontal plane; (d) increase of conductor clearances and separation and provision for longer insulator strings on new lines; (e) means for maintaining maximum clearance of strain-insulator jumpers.

Ground Relay Protection

In connection with the checking of ground relays by actually placing a ground on the line, some very interesting results have been obtained. Among the effects pointed out is the relation of ground current to phase voltage with different amounts of resistance in the high-tension transformer bank neutral.

This point was brought out very forcibly during some tests conducted by the Public Service Electric & Gas Company of New Jersey, which were made in July, 1926. A tabulation of the test data is shown on page 10. An analysis of these data shows that with no resistance in the transformer bank neutral a phase angle of around 90 deg. lag is obtained, and with a resistance of 75 ohms in the transformer bank neutral the phase angle varies from 5 deg. lag to 15 deg. lag, while with a resistance of 300 ohms in the transformer bank neutral the power factor ranges from unity to 18 deg. lead. As a result of the poor power factor obtained under conditions of the transformer bank neutral being solidly grounded, the resultant torque on the relay disk is very small, even though the fault current be relatively large, and if the phase angle is greater than 90 deg. lag, the direction of operation of the relay will be reversed.

Similar tests were conducted by the Duquesne Light Company during May of 1926 in order to determine the following points:

1. To determine the minimum amount of ground current on which the 50-watt power relays would operate.
2. To make an actual check on the direction of operation of the power ground relays.
3. To determine the effects of putting more than one potential element of the ground relays in parallel on the same set of auxiliary potential transformers.
4. To determine the sensitivity of the low-energy power directional ground relays as compared with the 50-watt power relays.

The test data are shown on page 10, and the conclusions arrived at are as follows:

1. The power relays set on a 50-watt tap would not operate satisfactorily with less than a 300-amp. ground, the ground being located at the substation at which the relays were installed. As the ground location would become farther away from the substation, the ground current necessary to operate the relay would become higher, due to less voltage being impressed on the power relay.
2. The direction of all ground relays tested was found to be correct.
3. The addition of an increased number of potential elements of ground relays to one set of auxiliary potential transformers did not result in any noticeable drop in voltage on the secondary of the auxiliary potential transformers. This indicated that the auxiliary potential transformers could be loaded up to their volt-ampere capacity.
4. It was found that the low-energy power directional ground relays would operate satisfactorily on a much lower ground current than the power relays.

As a result of the experiences of this and other companies, it is believed that the inside delta power directional ground relaying is the most reliable and satisfactory type of ground protection that can be used on a system having a resistance in its neutral circuit. On systems which are solidly grounded, other types of ground protection are used, among which are the impedance ground relay and the same type of power directional relay which is used for phase protection, except in the case of extremely long lines where, if the fault current is less than load current, other means of protecting the lines must be found.

It has also been the experience of this and other companies that the most satisfactory method of checking the connections of ground relays has been by actually placing grounds upon the lines in question, since there is less chance of error in this method than in any other. It is further felt that the increased cost of this method of testing is entirely justified from the standpoint of the better relay operation obtained and from the standpoint of reduction in number of interruptions, which is very important.

The problem of obtaining selective relay protection in case of accidental grounds on a high-tension, isolated-neutral system was considered by Messrs. Breisky, North and King. A relay was described which has proved effective in tests on the 140-kv. Michigan system and which involves overcurrent and directional elements. The first element is operated by residual charging current and the second by residuaal voltage and residual charging current.

Discussion on Relay Protection

Discussion at the Tuesday session centered chiefly around relay protection, although insulator performance came in for some comment. H. P. Sleeper declared that ground protection is justified to reduce damage at faults and to minimize stress on the system. In New Jersey, he declared, the relay system described by Messrs. Jones and Dodds has been used very effectively, a conductor-to-sheath ground being cleared

DIRECTIONAL GROUND RELAY TESTS (JONES AND DODDS)

Test Data of High-Tension Line Ground Tests Made by the Public Service Electric & Gas Company

	1	2	3	4	5	6	7	8	9
Test number	1	2	3	4	5	6	7	8	9
Date	7/11/26	7/11/27	7/11/27	7/11/26	7/11/26	7/11/26	7/11/26	7/11/26	7/11/26
Time	9:55 1 a.m.	10:30 a.m.	10:37 p.m.	12:15 a.m.	12:55 a.m.	2:45 p.m.	3:45 p.m.	4:00 p.m.	4:30 p.m.
Voltage of line tested, kv	26	26	26	26	26	26	26	26	26
Bank kilovolt-amperage	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000
Neutral resistance	0	300	300	300	300	75	75	75	0
Line grounded	Phase 1 of	Phase 1 of	Phase 1 of	Phase 3 of	Phase 3 of	Phase 3 of	Phase 1 of	Phase 2 of	Phase 2 of
Location of ground	X-102 1 mile from Essex	X-102 1 mile from Essex	X-102 1 mile from Essex	S-357 ¼ mile from Metuchen	S-357 ¼ mile from Metuchen	S-357 ¼ mile from Metuchen	R-356 1 mile from Essex	N-196 ¼ imle from Metuchen	N-196 ¼ mile from Metuchen
No. of ground relays in series on C.T.	1	1	1	1	1	1	1	2	2
Ground relay current setting	0.4	0.53	0.2	0.53	0.53	0.53	0.53	0.5	0.5
High-tension ground amperes	240	64	49.6	90+	102	178	99	160	420
Ground relay									
Volts	10	150 + (F. S.)	190	180	164	164	146	152	120
Watts	Meter reversed	120	98	240	245	450	230	280	2
Amperes	3.0	0.8	0.6	1.5+	1.7	2.97	1.65	2.0	9.4
Phase angle	93 deg. lag	7 deg. lead	10 deg. lead	0	18 deg. lead	10 deg. lag	5 deg. lag	15 deg. lag	90 deg. lag
Low-tension star volts before test									
1-N	65.0	66.2	67	63	63	63	63	63	62
2-N	65.1	65.5	66	62.9	62.6	62.6	62.7	63	62
3-N	64.5	65.0	65.5	63	63	63	63	63.5	62
Low-tension star volts during test									
1-N	64.5	23	23	106	101	99	24	93	64
2-N	68.8	88	87	98	98.5	97	84	20	33
3-N	63.0	106	106	20	18	18	97	92	82
Low-tension delta volts before test									
1-N								110	106.5
2-N								110.5	107.8
3-N								109.2	109
Low-tension delta volts during test									
1-N								109.5	103
2-N								111.5	97
3-N								109.2	94

so quickly in a 26-kv. cable joint that no outward evidence was produced. With a 75-ohm resistance in the neutral, grounds cause a voltage dip of only 2 to 4 per cent, compared with 10 per cent with a solid grounded neutral. Line loads can be used to check relays; field grounds are hardly justified, he declared. By changing the external connections it was suggested that the same relay might be used for isolated-neutral and grounded systems.

B. M. Jones reported that by applying 305 field grounds to check 484 relay installations seventeen field errors in connections or settings were located, whereas with 44 other installations six errors were found by applying 150 field grounds.

E. E. George confirmed many of Mr. Dodds' conclusions. On the Tennessee system he sets the ground relays light and fast, using two elements (overcurrent and directional), acting on one disk. Good success was reported with balanced relays and field grounds were favored for checking relays. Mr. George reported 22 flashovers per mile of line per year.

H. A. P. Langstaff emphasized the value of ground relays in reducing the duty on oil circuit breakers. Phase-balance protection is used on large motors started directly across the line on the West Penn system. Because of the difficulty of setting watt relays in conjunction with current relays, watt relays are being supplanted. Light and heavy field grounds are being used to check relays, but not so many as formerly.

George H. Doan reported the almost perfect functioning of mechanically balanced differential ground relays on the Detroit Edison system, but said that relays in general are not rugged and powerful enough. Portable test transformers and careful checking of connections were favored over field grounds for checking relays on a concentrated system.

L. N. Crichton declared that the voltage applied to the relays under consideration is that existing between the fault and source of power so a true wattmeter relay has a poor chance of working. The relays must be designed for lagging current. A phase-shifting device can be used if the neutral resistance is removed.

Regarding flashovers of insulators, Mr. Doan, Detroit Edison Company, reported that 77 per cent of them occur on the upper conductor on 120-kv. lines, giving 5 and 2.7 times line voltage as the induced voltages on the top and bottom conductors respectively. With ground wires on these lines the number of automatic switch openings from flashovers was reduced 94 per cent from those obtained without a ground wire, but there were 47 per cent fewer storms in the former case.

A. O. Austin presented a number of curves, including relations between line flashover voltage and cost per kilowatt of line with different types of construction, the value of wooden-pole insulation, and insulated ground wires. He alluded to the possible benefits from a counter-potential grounding system.

DIRECTIONAL GROUND RELAY TESTS (JONES AND DODDS)

Test Data of High-Tension Line Ground Tests Made by Duquesne Light Company

	1-A	1-B	1-C	2-A	2-B	2-C	3-A	3-B	3-C	4-A	5-B	6-A
Test number	1-A	1-B	1-C	2-A	2-B	2-C	3-A	3-B	3-C	4-A	5-B	6-A
Date	5/23/26	5/23/26	5/23/26	5/23/26	5/23/26	5/23/26	5/23/26	5/23/26	5/23/26	5/23/26	5/23/26	5/23/26
Time	9:48 a.m.	9:59 a.m.	10:11 a.m.	10:55 1.m.	10:44 1.m.	11:11 a.m.	12:11 a.m.	12:25 p.m.	12:36 p.m.	12:45 p.m.	2:39 p.m.	4:12 p.m.
Voltage of line tested, kn.	22	22	22	22	22	22	22	22	22	22	22	22
Type of C. T.	400/5 Bushing	400/5 Bushing	400/5 Bushing	400/5 Bushing	400/5 Bushing	400/5 Bushing	400/5 Bushing	400/5 Bushing	400/5 Bushing	400/5 Bushing	400/5 Bushing	400/5 Bushing
Line grounded	Beaver F.	Beaver F.	Beaver F.	Beaver F.	Beaver F.	Beaver F.	Morado	Morado	Morado			
Location of ground	Morado Morado	Morado Morado	Morado Morado	Morado Morado	Morado Morado	Morado Morado	Koppel Morado	Koppel Morado	Koppel Morado	Morado Morado Koppel	Morado Jct. Pk. Morado No. 1	Morado Jct. Pk. Morado No. 2
Bank kilovolt-amperage	10,000	10,000	10,000	10,000	10,000	10,000	10,00	10,000	10,000	10,000	10,000	10,000
Current to ground	60	80–100	Off scale 400	70–80	160	500	400	480	440	440	408	200
Current in ground relay	Could not read	0.5	Off scale	0			4.0				3.5	2.0
Direction of operation of ground relays	Overcurrent non-directional relays installed			Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed
Volts across potential coil of relay		5–10	Off scale	10	15	52	47	54	46	44	58	35
Low-tension star volts 1-N	62.5	61.5	62.4	62.5	62.5	62.5	49.5	off	65.	65.	63.5	63.5
Before 2-N	63.0	61.5	61.5	61.5	61.5	61.5	49.5	Off	65.	65.	64.0	64.
Test 3-N	64.5	64.5	62.7	67.7	64.0	67.0	49.5	Off	66.	66.	65.0	64.
Low-tension star volt 1-N.	61.0	60.0		59.6	53.5	37.0	45.0		68.	42.	67.	67.
During 2-N	64.5	62.5		63.0	67.0	72.0	49.0	45.	52.	70	51	68
Test 3-N	64.0	64.0		63.0	64.0	67.0	45.0	35	75	66	72	68
Neutral resistor	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75
Phase angle					18 deg. lag	18 deg. lag						

Technical Committees Review Conditions

Research—J. B. WHITEHEAD, chairman.
Electrophysics — VLADIMIR KARAPETOFF, chairman.
Education—P. M. LINCOLN, chairman.
Standards—J. F. MEYER, chairman.
Instruments and Measurements — A. E. KNOWLTON, chairman.
Communication — H. P. CHARLESWORTH, chairman.
Production and Application of Light—P. S. MILLAR, chairman.
Electrical Machinery—H. M. HOBART, chairman.
Power Generation—W. S. GORSUCH, chairman.
Power Transmission and Distribution—PHILIP TORCHIO, chairman.
Protective Devices—F. L. HUNT, chairman.
Applications to Iron and Steel Production—A. G. PIERCE, chairman.
Application to Mining Work—W. H. LESSER, chairman.
Applications to Marine Work—G. A. PIERCE, chairman.
Transportation—J. V. B. DUER, chairman.
Electric Welding—J. C. LINCOLN, chairman.
Electrochemistry and Electrometallurgy — G. W. VINAL, chairman.

A SPLENDID series of committee reports were presented at one of the parallel sessions on Wednesday morning. The research committee was brief but contained a statement to the effect that half the research in colleges was done by eight men. This called forth a large amount of discussion. Dean C. E. Magnusson and Prof. R. W. Sorenson took issue with this statement and gave a report on research work now going on. They also pointed out that many colleges could do little research because money was lacking and they urged a closer contact between industry and colleges and said many researches could be conducted by colleges were industry willing to advance the funds.

Other reports presented at the meeting received little discussion, for each committee chairman gave a report which served to survey the state of the art in the several fields of electrophysics, education, standards, instruments and measurements, communication, light and machinery. The electrical machinery report was a fine job of summarizing progress and received much favorable comment.

STATUS OF TURBO-GENERATORS

The past year has seen the realization of the predicted possibilities in large high-speed turbo-generators, pointed out H. M. Hobart in his committee report. There are under construction generators of the following ratings:

Single-Shaft Units.

100,000 kva., 90 per cent power factor, 1,500 r.p.m.

75,000 kva., 80 per cent power factor, 1,800 r.p.m.

Triple-Shaft Units.

Two 64,706 kva., 85 per cent power factor, 1,800 r.p.m. and one 57,647 kva., 85 per cent power factor, 1,800 r.p.m. with two 4,286-kva. house service generators to form a 165,000-kw. unit.

Two 72,941 kva., 85 per cent power factor, 1,800 r.p.m., and one 89,412 kva., 85 per cent power factor, 1,800 r.p.m. with two 5,333-kva. house service generators to form a 208,000-kw. unit.

The present tendency to very large generating units and ever-increasing station capacities has made the switching problem, on account of the enormous currents involved, a serious one. This situation is being met in some instances by connecting step-up transformers directly to the generator terminals and doing all the switching on the high-tension side of the transformers. In other cases the generators are being built to operate at voltages considerably higher than those previously employed. As examples of the latter practice, the two 100,000-kva. units mentioned above are being constructed for 16,500-volt operation; the main generators of the 208,000-kw. triple shaft unit above referred to will operate at 22,000 volts, and there is also under construction a single-shaft generator of 61,675-kva. capacity which will operate at 22,000 volts. All of these will have dielectric tests in accordance with the A.I.E.E. standard—that is, twice normal voltage plus 1,000 volts.

TRANSFORMER DEVELOPMENTS

The largest artificially cooled single-phase transformers were completed this year. They are rated at 31,400 kva., 60 cycle, 12,000 to 132,000 (Y) volts and are water cooled. These transformers, while of greater rating, do not exceed in physical size the 28,000-kva., three-winding transformers shipped two years ago to Japan. These three-winding units, of American manufacture, have not been exceeded in physical size by any other water-cooled transformer. The present maximum capacity for two-winding transformers will be exceeded upon the completion of some 33,333-kva., two-winding transformers now under construction. The 33,333-kva. units are for 220,000-volt service, for which a great number of units has been constructed during the year. They are cooled by radiators with forced air cooling and are the largest size to which this method of cooling has been applied.

The largest totally self-cooled transformers were recently put in operation. They are rated at 25,000 kva., three phase, 60 cycles, stepping up from 13,000 to 120,000 volts. The windings are equipped with tap changers designed for future tap changing under load. An overload capacity giving 35,000 kva. is obtained by means of forced oil circulation through the cooler.

For use in underground distribution systems, a new subway transformer tank has been developed which is suitable for larger capacities, higher voltages and heavier currents. The junction boxes form an integral part of the tank and provide adequate high and low-voltage terminal facilities.

The demand for squirrel-cage motors, suitable for starting at full voltage without compensator or other starting device, has very greatly increased during the past year. Where the service does not require very heavy starting torque, such as centrifugal pumps, blowers, motor-generator sets, etc., the starting current can be reduced sufficiently without reducing the starting torque beyond the requirements by simply increasing the reactance of the squirrel-cage winding. For other classes of service where a normal or even a high starting torque is required, the situation is met by adding a second higher resistance squirrel-cage to the regular working winding which still has high reactance.

Committee reports on different phases of power generation, transmission and utilization were presented at a parallel session on Wednesday.

STATUS OF POWER GENERATION

One of the outstanding features in power development, said W. S. Gorsuch

PARTIAL LIST OF INTENSIVE STREET LIGHTING SYSTEMS AS OF MARCH, 1927
(P. S. MILLAR)

	Lumens per Linear Foot of Street*	
Chicago—State Street	2000	2-lamp tungsten
Seattle—Metropolitan Avenue	1050	2-lamp tungsten
Jersey City, N. J.—Journal Square Plaza	857	1-lamp tungsten
Salt Lake City—business section	822	3-lamp arc
Niagara Falls—Falls Street	761	2-lamp arc
San Francisco—Market Street	750	3-lamp arc
Schenectady—Erie Boulevard	700	2-lamp arc
Portland, Ore.—business district	600	2-lamp tungsten
Columbus, Ohio—business district	600	2-lamp tungsten
Schenectady—State Street	585	2-lamp arc
Los Angeles—several streets	375 to 510	2-lamp tungsten
Indianapolis—business section	520	2 lamp tungsten
Los Angeles—Broadway	510	2-lamp arc
San Francisco—Triangle district	500	2-lamp arc
El Paso—business section	500	2-lamp arc
Cleveland—Superior Avenue	500	1-lamp tungsten
Rochester, N. Y.—East Main Street and East Avenue	472	2-lamp arc
Lynn, Mass.—Central Avenue	450	2-lamp arc
Augusta, Ga.—Broad Street	450	2-lamp tungsten
Davenport, Iowa—business section	450	2-lamp tungsten
Syracuse—business section	425	2-lamp arc
Boston—several business streets	400	1-lamp arc
Boston—Massachusetts Avenue	400	1-lamp tungsten
Lansing, Mich.—business section	400	2-lamp tungsten
Lawrence, Mass.—Essex Street	400	2-lamp tungsten
Chicago—South State Street	400	1-lamp tungsten
Gary, Ind.—business district	381	2-lamp tungsten
Lynn, Mass.—business district	351	1-lamp arc
Racine, Wis.—business district	350	1-lamp tungsten
Chattanooga, Tenn.—business district	340	1-lamp tungsten
Cleveland—business district	333	1-lamp tungsten
Worcester, Mass	325	1-lamp arc
Utica—business district	304	1-lamp arc
Saratoga—Broadway	300	2-lamp tungsten
Lowell, Mass	300	1-lamp arc
Nashua, N. H.—business section	300	1-lamp arc
Providence, R. I.—business section	300	1-lamp arc

*As an index of grade of lighting "lumens per linear foot" is evidently inexact. No better basis of terse statement is, however, available for these installations.

in his committee report, is the tremendous increase in the so-called ultimate station capacity over that anticipated at the time of the initial installation. In some cases the ultimate capacity will probably be more than double that originally expected. What has brought this about is the unprecedented increase in system loads and the introduction of units of much larger capacity than those first installed. In the eternal quest for greater and yet greater economies in power stations, notable technical achievements have been brought about in practically every line of the industry.

The desire to secure high efficiencies in steam power plants has resulted in rapid increase in pressure and temperature to a maximum of 1,400 lb. and 750 deg. F. in this country. In the United States the boiler pressures in large steam power plants have been confined to three classes of approximately 1,400 lb., 600 lb. and 400 lb., the steam pressure at the turbine throttle being about 1,200 lb., 550 lb. and 350 lb. respectively. These pressures represent about the average conditions, some may be 5 per cent or 10 per cent above or below. There appears to have developed three schools of engineering for the above pressures, and each is apparently convinced that the pressure which it has adopted is the most economical one. From the turbine designer's standpoint no insurmountable problems have been presented up to the highest pressures so far considered.

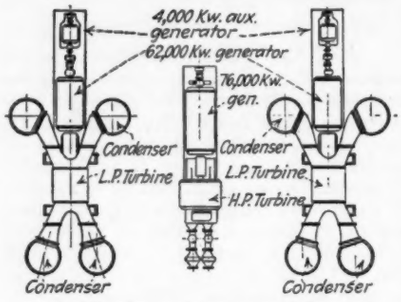
NEW DEVELOPMENT IN REHEATING STEAM

Reheating of the steam after it has completed a portion of its expansion has proved satisfactory and successful where applied. Reheating in the boiler room, however, requires large piping to and from the reheating boiler and also involves some loss in pressure, which partly offsets the gains from reheating. This year has brought out a new development largely overcoming these objections and it is now proposed to reheat the steam at or near the turbine, using high-pressure live steam.

With the increase in size of steam turbine-driven generators, which today have reached a maximum of 100,000 kva., an increase in the generator voltage is desirable. It is well known that this higher voltage will, by decreasing the current, effect a considerable reduction in the cost of buses, switches, cables, etc., and probably before very long many generators of 50,000 kva. and upward will be wound for higher voltages than have prevailed heretofore. As an illustration of this trend there are now under construction a 100,000-kva. generator for 16,500-volt operation, the generators for a 208,000-kw. cross-compound three-element unit to be operated at 22,000 volts, and also a single-shaft generator of 61,765 kva. that will operate at 22,000 volts.

There has been a marked reduction in the ratio of square feet of condenser surface to kilowatt capacity of the turbine. This has been brought about because of a more intelligent arrangement of tubes in providing lanes that give a proper direction of the steam flow, bleeding of turbines and improved turbine water rates. An investigation regarding condenser installations in modern power plants shows that, among 40 of the most prominent power stations completed within the last two years, only two have a ratio of condenser surface to kilowatt of normal turbine capacity under 1.

The benefits of highly preheated air both for stokers and for powdered coal firing are becoming more generally



208,000-KW. UNIT FOR STATE LINE (GORSUCH)

realized. Developments in air preheaters have been rapid. It is probable that new stations will install air preheaters of such a capacity that the flue gases will be cooled to relatively low temperatures.

As an indication of the trend toward the great increase in fuel-burning capacity per foot of furnace width, stokers with 45 tuyères that will underfeed coal for distance of 16 ft. are being installed in furnaces 19 ft. 5½ in. from the inside of front wall to the rear breaker apron of the clinker grinders, in extensions to the Edgar station.

The size of pulverized-fuel furnaces for a given amount of heat liberated is definitely on the decline. Turbulence accomplished in one way or another, to secure agitation and rapid mixing of air and carbon, greatly accelerating and improving combustion, has obviated the need for large combustion chambers formerly thought necessary to accomplish the same result. Preheated air and water-cooled walls have also played a part in the reduction of furnace volume. All of these factors have either permitted or dictated that less excess air be introduced in the furnace, thus allowing a smaller combustion space.

If a forecast can be made of developments, these will include turbulent firing, simplified storage systems, methods of drying of the fuel and mills of greatly increased capacity. Through these developments still greater advantages will be realized by the use of pulverized fuel in central-station practice. The opinion has been expressed that powdered fuel firing will probably be the standard method of the future, as it will be impossible to burn sufficient coal per square foot on a stoker to develop the capacities which will be required. However, no clear-cut supremacy has as yet been demonstrated and the fact must not be lost sight of that stoker development has proceeded at a brisk pace with no indications of a diminution.

PULVERIZED COAL INSTALLATIONS

	No.	Capacity, Kw.
Installations in operation	40	2,200,000
Installations under construction.	7	440,000
Total	47	2,640,000
Installations in operation and under construction, entirely operated with pulverized coal.	27	1,700,000
Plants with 40,000 kw. capacity or more, operated with pulverized coal	27	2,250,000

The rapid introduction of pulverized fuel into steam-generating stations is indicated by the fact that at the present time 40 public utility plants in the United States either partly or fully operate with pulverized coal, the aggregate generator capacity so fired being 2,200,000 kw. This is exclusive of several installations in steam-heating plants. In addition to this there are now under construction five new plants and extensions to the old plants, having together a total capacity of 440,000 kw., all of which will be operated with pulverized coal. The significance of these figures can better be appreciated from a review the tabulation which appears above.

POWER PRODUCTION ECONOMIES

A record for thermal efficiency was attained at the Columbia station of the Columbia Power Company in Ohio. For a period of one month this station was operated on a heat consumption of approximately 12,462 B.t.u. per kilowatt-hour net output, which is the lowest figure obtained by any steam plant to date. The following figures, for two consecutive months, are of particular interest:

PERFORMANCE OF COLUMBIA STATION DURING TWO MONTHS (GORSUCH)

	December, 1926	January, 1927
Kilowatt-hours net output	44,998,400	42,547,900
Load factor	65.7%	60.7%
British thermal unit per kilowatt-hour net output	12,495	12,462
British thermal unit per pound coal as fired	13,838	14,002
Coal factor, pounds per kilowatt-hour net output	0.903	0.890
Stationwater rate	7.76	7.85
Average rating and efficiency of standard boilers—EFF.	87.06 %	87.54 %
—RAT.	216%	233%
Average rating and efficiency of reheat boilers—EFF.	90.7%	90.92%
—RAT.	408%	422%
Auxiliary power consumption	5.27%	5.41%

The results in many other stations put into operation during the last year have also been very reassuring and in some cases have exceeded the expectations of their designers. High pressures, high temperatures, water walls, regenerative cycle, reheat cycle, air preheaters, improved combustion due to better stokers or pulverized fuel, reduction in exit gas losses by economizers and preheaters, use of electrical drives

for auxiliaries, and improvements in turbine and condenser design have all contributed to improve the thermal efficiency of power plants so that the reduction of operating costs have more than kept pace with the increased price of fuel and increased operating labor rates.

AUTOMATIC COMBUSTION CONTROL

Considerable progress has been made in the development and application of automatic combustion control equipment to stoker firing, pulverized fuel and oil burning. Engineers are giving increased attention to this equipment, which, judging from the number of installations in operation at the present time, is apparently well advanced from the development stage and should assume a major rôle in the process of converting the heat in the coal to heat in steam in the most economical manner possible.

Complete automatic combustion control has been in operation for some time in several of the outstanding power stations in the East, and the companies report satisfactory performance of the equipment. Results show that daily operating efficiencies are maintained within 2 per cent of test efficiencies.

DISCUSSION ON POWER GENERATION

Evidently the report was so complete that very little discussion ensued. Philip Torchio referred to the confusion which arises in referring to the total capacity of large multi-element units, said that manufacturers have evidently not reached the limit in generator sizes and pointed out that coal economies are being made at the expense of increased capital investment. F. A. Scheffler figured that in the 38 utility power plants using powdered fuel and rated at approximately 2,640,000 kw. about 17 per cent of the utility coal consumption is absorbed. W. S. Gorsuch urged the study of hydro and steam economies because of increasing interconnections.

STATUS OF LIGHTNING PROTECTION

From the results of the researches of the several investigators, the following significant summary of present knowledge may be made, pointed out F. L. Hunt in his committee report:

1. Lightning strokes are unidirectional.

2. Positively charged clouds discharge in about one one-hundredth of a second; negatively charged, in about three microseconds.

3. Surge voltages due to lightning are usually unidirectional. The clouds which produce surges are of negative polarity, resulting in positive induced voltages and negative direct-stroke voltages. Oscillatory surges are the result of flashovers and are highly damped.

4. The wave front steepness or time required for a lightning surge to reach its crest lies within the broad range between about one one-hundredth of a second and one microsecond. The steepest waves probably reach their crest in a time of the same order as that required for the discharge of a negatively charged cloud—namely, about three microseconds.

5. The maximum potential of lightning surges agrees with theory and laboratory tests and is limited by the flashover value of the line insulators.

6. Lightning arrester performance in service confirms laboratory tests.

It is believed that the demand of the art at the present time for the adoption of a standard transient for lightning arrester testing is sufficient to justify the adoption at this time of a tentative standard. Therefore, in the formulation of standards for lightning arresters, in which work the sub-committee is now actively engaged, it is proposed to establish a standard lightning surge for laboratory use which it is proposed to define as follows:

"The standard lightning surge shall be one which rises to its crest value in four microseconds and which does not decrease more than 2 per cent in the following ten microseconds."

For the purposes of lightning arrester standardization, it is proposed to fix the maximum value of the standard lightning surge at 100 kv. in order to limit the size of the necessary laboratory equipment.

A. Herz called attention to the necessity of considering atmospheric effects on klydonograph films when analyzing them. J. Allen Johnson declared that since lightning arresters must handle transient voltages it is time that transient surges be standardized to afford some basis for comparison. He invited opinions on what should constitute a standard surge.

CURRENT TRANSFORMER STUDIES

Characteristic ratio curves for current transformers should have a lower limit of 1-amp. secondary current and an upper limit determined by any one of the following three conditions: 10,000-amp. primary current, twenty times normal rated current, two times nominal ratio.

Characteristic ratio curves should be furnished for both "instrument" and "bushing" type current transformers for inductive burdens, power factor 0.5 as follows: 15 volt-amp., 25 volt-amp., 50 volt-amp., 100-volt-amp., 200 volt-amp. All values of volt-amperes given are based on 5 amp., 60 cycles. The various loads are also to be specified in ohms resistance and henries inductance.

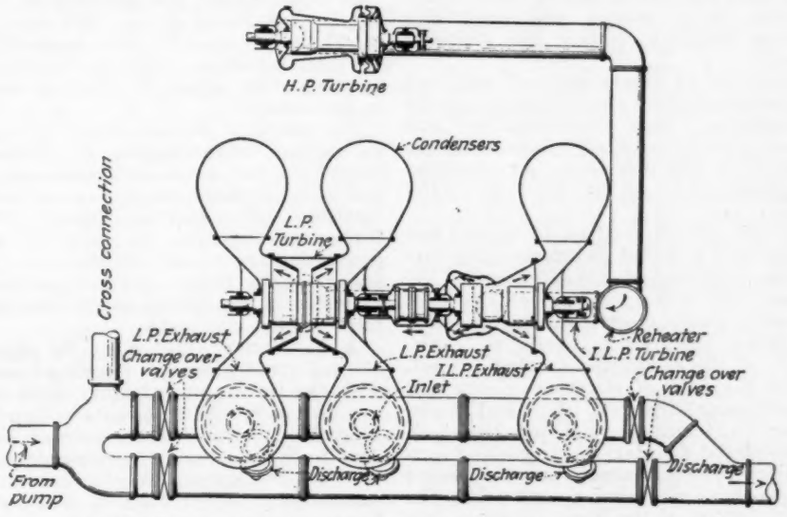
Until further experience may demonstrate that more narrow limits may be adhered to, the manufacturers should furnish, for each type and ratio of current transformer, a characteristic curve which shall be correct within the following limits:

(a) ± 2½ per cent deviation from standard curve up to 1.1 times nominal ratio.

(b) ± 10 per cent deviation from standard curve at 2 times nominal ratio.

(c) The deviations at points between 1.1 and 2 times nominal ratio shall be interpolated on a straight line basis.

Change in phase angle under high-current conditions. Some change in phase angle undoubtedly does occur, especially with "bushing" type current transformers in connection with large non-inductive secondary burden. It is thought that under conditions normally met in operation with secondary burdens approximating 0.5 power factor this change in phase angle will have no serious effect on relaying. Information is lacking, however, on this point and it is recommended that more complete tests be made.



104,000-KW. UNIT FOR CRAWFORD AVENUE STATION (GORSUCH)

In his report on transmission and distribution, Philip Torchio (chairman) gave in brief form some of the observations resulting from klydonograph analyses, commented on the magnitude of lightning discharges and the effect of ground wires and tower design, reviewed lightning protection of distribution circuits, including primary and secondary exposure, shielding and lightning entrance, and considered stability and load limitations, underground cables and use of temperature indicators.

In discussing the subject, D. W. Roper announced that one-third of the lightning surges in distribution transformers apparently enter by way of the secondary wires, so that lightning arresters cannot be blamed for failure to stop them. In reply to a question raised, Mr. Torchio said that since cables are usually operated below voltage rating, test voltage of three and one-half times rating leaves considerable margin for surges. He also re-

ferred to transposing single-conductor cables at every manhole, insulation of two conductor sleeves and grounding of the other.

SIX OTHER COMMITTEE REPORTS

A marked increase in application of electricity to coal mining to reduce production costs was reported by the committee on applications to mining (W. H. Lesser chairman). Coal-loading machinery has reduced costs 25 cents to 35 cents per ton. Storage-battery coal cutters are increasing. Improvements in haulage systems and increased usage of automatic starting equipment and electric shovels were reported.

Discussion centered chiefly around whether the Bureau of Mines should issue unqualified or limited approvals of equipment.

The committee report on marine work (G. A. Pierce chairman) indicated that electric drive is gaining headway for deck machinery, engine-room auxiliaries, cargo pumps and propulsion where frequent starting and stopping occur.

Reports on steam railroad, city and suburban railway electrification, marine propulsion, bus transportation and recent development were included in the report of the committee on electrical transportation (J. V. B. Duer chairman).

Steel-mill applications during the last year have included 25 arc-smelting furnaces, heating of auxiliary rolls, 150 main roll drives, individual drive of auxiliary rolls, electric welding and heat treating, declared A. G. Pierce, chairman of the committee on that subject.

In the field of electrochemistry and electrometallurgy (G. W. Vinal chairman) a tentative standard has been formulated defining the terms and conditions which characterize the rating and behavior of storage batteries. The introduction of the high-frequency furnace in steel foundries has been a notable step, electric furnaces, in general, being used where quality of product is important. It is now possible to electrodeposit rubber.

The committee on electric welding (J. C. Lincoln chairman) presented a number of facts showing the values of this process in locomotive boiler repairs, shipbuilding, welding structural steel, welding pipe lines and replacing castings. Most of the 600,000 tons of steel castings have minor defects which are now repaired by arc welding. Electric welding is estimated to be saving railroads $12,000,000 per year in boiler repair. By using arc-welded joints for 90 miles of 6-ft. pipe line $3,000,000 was saved. Particular stress was laid on the savings to be made from using welded structural shapes instead of castings. When it is recognized that a welded joint can be made as strong as the plate, whereas a riveted joint is only 75 per cent of that strength, the plate thickness can be reduced without reducing the factor of safety.

Discussions involved relative effectiveness of direct-current and alternating-current welding, means of making welded rail joints more satisfactory, welding of oil tanks, attitude of I. C. C. on welding of locomotive boilers and insurance authorities on arc-welding of fired-pressure vessels. J. C. Lincoln declared for the greater effectiveness of direct-current metallic arc welding. F. W. Funk referred to the use of automatic welding for oil tanks. Mr. Lincoln said that small holes can be drilled in welded rail joints to terminate hair cracks which may develop, that the A.S.M.E. is studying but does not yet permit arc-welding of fired pressure vessels, and invited every one to report unusual arc phenomena that may throw light on the principle of operation.

Television Attracts Audience

"Printing Telegraphs on Non-Loaded Ocean Cables."
By HERBERT ANGEL, Western Union Telegraph Company.
"A Non-Rotary Regenerative Telegraph Repeater."
By A. F. CONNERY, Postal Telegraph Cable Company.
"Electrical Reproduction from Phonograph Records."
By E. W. KELLOGG, General Electric Company.
"Symposium on Television."
Led by DR. H. E. IVES, Bell Telephone Laboratories.

AS indicated by the subjects of the papers listed above, this session on Thursday morning was essentially for communication engineers, television figuring more largely in this field than in any other.

The paper by Herbert Angel referred to various improvements in printing telegraphs for non-loaded ocean cables and the increased production secured. Methods of restoring signals lost through attenuation by means of regenerative repeaters constituted the feature of this paper. An increase from 70 letters to 375 letters per minute was reported for one cable.

A. F. Connery, discussing the paper, claimed greater ease in detecting errors with the three-unit code than with the five-unit code. With the rotary distributor, W. A. Houghtaling pointed out, four to five channels of communication can be developed. W. C. Peterman summarized the problem of long-cable telegraphy as being one of transmitting the maximum number of signal cycles and securing sufficiently strong intelligible signals. Mr. Angel contended that the system he described is as accurate as the Morse cable code.

A non-rotary regenerative telegraph repeater involving a synchronized tuning fork was described by A. F. Connery, who claimed for the development reduced first cost, lower maintenance and less floor space.

In discussing the paper W. C. Peterman pointed out that Mr. Angel's repeater entirely regenerates signals. Mr. Angel favored the rotary relay to take off printer circuits. Mr. Connery contended that the non-rotary repeater is simpler and can be maintained by non-technical attendants. Until recently brush transmission was considered better than relays, but developments in the latter have improved their standing.

The electromagnetic principle of phonograph "pick-up" was the principal subject discussed in Mr. Kellogg's paper, several modifications being considered, with their advantages and disadvantages and methods of securing least distortion and maximum sensitivity.

C. R. Hanna, who commented on this paper, referred to two factors which effect sensitivity, magnetic effect on restoring force being one and inductance the other. He claimed that none of the magnetic "pick-up" methods has any great advantage over another, leaving great freedom of choice.

The symposium on television headed by Dr. Herbert E. Ives and the subsequent demonstration were very popular, judging by the large audience attracted. Although a very comprehensive treatment of the subject was afforded in the printed papers, contributed to by Messrs. Gray, Horton, Mathes, Stoller, Morton, Gannett, Green and Nelson, Dr. Ives interpreted the whole subject, its problems and their solution, in language sufficiently non-technical to be understood by laymen. The use of neon glow lamps, potassium photoelectric cells, a scanning light beam and a novel synchronizing arrangement are features of the present mechanism of television.

High-Tension Joints and High-Frequency Control of Distant Switches

"High-Voltage Multiple-Conductor Joints."
By T. F. PETERSON, Brooklyn Edison Company.
"Use of High-Frequency Currents for Control."
By C. A. BODDIE, Westinghouse Electric & Manufacturing Company.
"Electromagnetic Waves Guided by Parallel Wires."
By S. A. LEVIN, National Electric Light Association.
"The International Electrical Units."
By E. C. CRITTENDEN, Bureau of Standards.

A DIVERSIFIED program was presented in one of the parallel sessions held on Thursday morning. The paper of T. F. Peterson dealing with three-conductor cable joints created a great deal of discussion. The accompanying illustrations show the types of joint developed after much work and these joints were reported to be very satisfactory in service. In discussing this paper D. W. Roper said that single-conductor cable joints made up on the same principles as the joint described by Mr. Peterson had been found satisfactory. He accented the need for trained men in cable jointing and reported that 750 joints on 66-kv. cable in Chicago had been in service a total of 400 joint years without any failures. E. D. Eby urged the use of stepped insulation instead of penciled insulation. D. M. Simons said the foil should be carried to the joint, but that opinion differed as to the advantage of carrying the metal

across the joint. If the filling compound is thin the Peterson joint is good, but if the compound is heavy there are advantages in carrying the metal across the joint. Several other presentations were made of cable joints and an active discussion was had which brought out the fact that joints in high-voltage cables were now found to be very satisfactory.

CONTROLLING REMOTE SWITCHES

The second paper on the program dealt with the use of medium and high-frequency control circuits on power wires. The author, C. A. Boddie, outlined the status of developments and explained where the new controls could be applied. In discussing the paper Chester Lichtenberg pointed out that the cost of terminal apparatus must be considered and he also stated that control circuits on power wires gave difficulty in some switching operations. The fields of application of different systems must be studied and each job of control required special engineering studies.

A generalized solution of electromagnetic waves on parallel wires, including the earth effect, was presented in a paper by S. A. Levin. In discussing the paper Prof. V. Karapetoff stated the author should give detailed explanations of all assumptions made so that no misconceptions might arise in the use of the equations developed.

An interesting paper on the present status of international electrical units was presented by E. C. Crittenden. The point was made that the arbitrary ohm differed by about one-twentieth of 1 per cent from the theoretical ohm and it might be advisable to make the correction. The author also said it might be well to make the standard international unit in terms of electromagnetic effects instead of using the present column of mercury and silver voltammeter.

Upon recommendation of Dr. Kouwenhoven the meeting voted to refer these topics to the instruments and measurements committee for study and comment at the next midwinter convention.

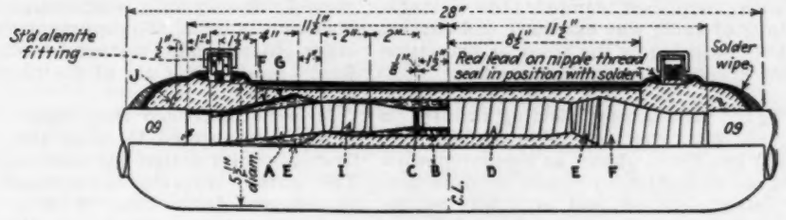
CONSTRUCTION OF HIGH-TENSION CABLE JOINTS

For some time manufacturers and those engaged in testing cable had suffered a serious handicap in not being able to carry tests of three-conductor cable to satisfactory completion because of breakdowns which invariably occurred at the crotches. T. F. Peterson was confronted with and quite successfully solved this problem about two and one-half years ago. Examinations of crotch failures of cable tested under oil indicated that there were three outstanding causes for these—namely:

1. Ruptured conductor insulation due to sharp bending.
2. Breakdown of film of oil and then paper at crotch.
3. Circumferential stresses on conductors.

The first was removed by fanning out legs in stages—that is, removing part of belt and bending legs, using edge of belt as a fulcrum.

The second did not yield so readily to the corrective measures applied. The attack was based on observations made during two tests devised to bring out the existence of this cause.



Detail of Joint in Belted Cable

SPECIFICATIONS FOR THREE-CONDUCTOR, 27,000-VOLT BELTED CABLE JOINT (PETERSON)

A. One layer, ⅜-in. black varnished cambric on each conductor
B. One layer, ⅜-in., black varnished cambric on each connector
C. Varnished cambric strips ½ in to ¾ in. wide to level of connector diameter
D. Paper tape
E. ⅜-in. black varnished cambric conical wound
F. One layer ⅛-in. lead foil around all three conductors
G. Black varnished cambric around all three conductors
H. Varnished cambric 1/16 in. thick, 4 in. from bell
I. Remove varnished cambric tape 2 in. from edge of pencil, also one layer of conductor insulation before applying paper tape
J. Bell to be beaten into original position after the operation of finishing the crotch has been completed

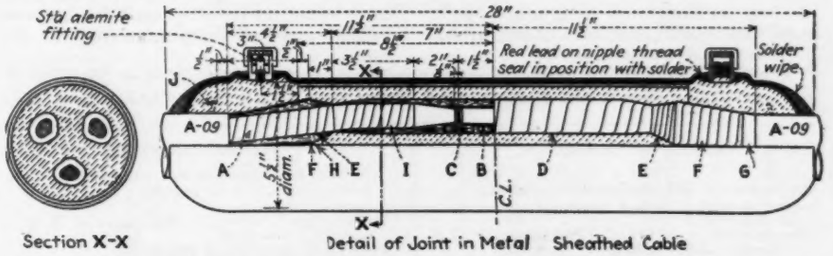
A roll of impregnated tape was used as a spreader in a crotch. After application of three-phase voltage, the roll was badly burned due to breakdown of oil at its center. At another time a sample was prepared and the crotch placed in a glass jar of clear oil. Spark discharge across film of oil in crotch was very much in evidence.

The dielectric constant of oil is approximately 2.5 and that of impregnated paper 3.2 to 4.1. When insulations are in series in a dielectric circuit, distribution of stress is in inverse proportion to dielectric constant. It is seen, therefore, why oil or compound was stressed beyond its rupturing strength, broke down and the resultant heating, charring, etc., finally culminated in breakdown of adjacent paper.

Circumferential stresses on conductors manifested themselves by the appearance of tree formations at crotches through several layers of paper on the backs of conductors of certain types of cable, though these very rarely resulted in failure.

A rather simple solution for these difficulties was arrived at after making some exhaustive tests using barriers, cotton and the like jammed into crotches, short circuiting oil by wrapping legs with electrostatic shields, using wrapping of wick. Finally, after carefully bending conductors, each leg was built up conically with black varnished cambric tape starting deep in the crotch and extending out 5 in., the maximum thickness being ⅜ in., 4 in. from belt edge. The conductors were drawn together and a varnished cambric belt was applied at crotch to the level of the factory belt. Then the lead sheath of cable was extended, using lead foil, to the point of maximum thickness of varnished cambric. The lead foil and varnished cambric belt were punctured to allow oil to enter where fillers would normally be employed.

With this type of construction overstressed oil films at crotch were replaced with varnished cambric. The latter with its high dielectric constant (approximately 5) in comparison with impregnated paper (approximately 3) assumed very little of the total stress between conductors but still took a sufficient per cent to relieve the paper at crotch and make the stress in it considerably lower than in the rest of the cable. The foil served to eliminate circumferential stresses by maintaining a zero potential surface at a distance outward from the center of the conductors equal to the distance inward to the actual neutral axis of the cable. Similar crotches were used in testing metal-sheathed cables, except that after building up individual legs



Section X-X

Detail of Joint in Metal Sheathed Cable

SPECIFICATIONS FOR THREE-CONDUCTOR, 27,000-VOLT, METAL-SHEATHED CABLE JOINT (PETERSON)

A. One layer ⅜-in. black varnished cambric on each conductor
B. One layer ⅜-in. black varnished cambric on each connector
C. Varnished cambric strips ½ to ¾ in. wide to level of connector diameter
D. Paper tape
E. ⅜-in. black varnished cambric conical wound
F. One layer ⅛-in. lead foil on each conductor from highest point to the bottom of the crotch and in contact with the copper foil on conductors which comprise the cable.
G. ⅛-in lead foil two layers around all three conductors and in contact with outer metallic tape of cable
H. Varnished cambric 1/16 in. thick 4 in. from bell
I. Remove varnished cambric tape 3½ in. from edge of pencil; also one layer of conductor insulation before applying paper tape
J. Bell to be beaten into original position after crotch is finished

with varnished cambric the metallic tape of cable was extended and carried over each leg to the point of maximum thicknesses of varnished cambric.

Results with this construction were highly satisfactory, yielding failures in cable after runs of 35 to 50 hours at 120 kv., three phase, as compared with three to eight-hour crotch failures previously obtained, and so it was recommended for use in crotches of joints on our 27-kv. system. In the latter rôle the applied varnished cambric served not only as a reinforcement but also as a spacer, thus eliminating another objectionable feature of existing joint—namely, the use of the porcelain spreader.

It is not intended that these statements be construed to mean that perfection in joint design has been reached. The author expects to attempt improvements from time to time and profit by criticism which will undoubtedly accompany its more general adoption.

Results of Recent Dielectric Research

"Puncture Voltage as a Precision Measurement."
By V. BUSH and P. H. MOON, Massachusetts Institute of Technology.
"The Electrical Resistivity of Insulating Materials."
By H. L. CURTIS, Bureau of Standards.
"Electric Strength of Solid and Liquid Dielectrics."
By W. A. DEL MAR, Habirshaw Cable & Wire Corporation; W. F. DAVIDSON, Brooklyn Edison Company, and R. H. MARVIN, Johns Hopkins University.
"Mercury Arc Rectifier Phenomena."
By D. C. PRINCE, General Electric Company.
"An Investigation of Corona Loss."
By E. C. STARR and W. L. LLOYD, General Electric Company.
"Law of Corona and Dielectric Strength."
By F. W. PEEK, General Electric Company.

DIELECTRIC and corona studies made up a fine program in one of the parallel sessions on Friday morning. Measurement methods in corona loss determinations were described by E. C. Starr and W. L. Lloyd.

The low-voltage cathode-ray oscillograph is well adapted to investigations of phenomena involving small currents of complex wave shape. This instrument was used in a study of the volt-ampere characteristics of the corona discharge. The circuit employed was such that the figures (cyclograms) traced on the screen of the tube were volt-ampere diagrams.

The cyclograms give accurate indications of the structural nature and characteristics of the corona discharge.

Some of these characteristics were checked visually by means of the stroboscope.

The following conclusions were drawn regarding the power loss and starting voltage:

1. Above the "visual critical voltage," e_v, as given in Mr. Peek's early work, the loss-voltage relation is a quadratic.

2. For polished solid conductors the loss suddenly jumps from zero to a definite value at e_v and then follows a quadratic.

3. For cables and roughened solid conductors the excess loss above or below that given by the quadratic law approximately follows the probability law below e_v. This excess loss may be either positive or negative, or both.

4. The critical disruptive gradients and particularly the visual critical gradients as determined in Mr. Peek's early work were closely checked.

5. The loss near the starting voltage is greatly affected by the regularity and condition of the conductor surface.

The characteristics of the discharge are briefly as follows:

1. For polished solid conductors the individual discharges, particularly the negative, start suddenly and are accompanied by heavy rushes of current.

2. For roughened solid conductors or cables the individual discharges start gradually and the current waves contain no sharp breaks.

3. The instantaneous disruptive voltages decrease with increasing line voltage.

4. The individual discharges stop near the crests of the voltage waves.

In an able paper F. W. Peek checked up on present knowledge of corona loss and the mechanism of corona formation. Curves were shown for different kinds of conductors and conductor surfaces and data given on corona loss. An interesting development from cyclograms was an explanation of the mechanism of corona formation. C. F. Harding discussed this paper and said measurements over a period of years on actual lines showed corona loss at higher voltage values was slightly lower than the values calculated by the Peek formula.

The general theory of electric conduction in gases, liquids and solids was presented in a paper by H. L. Curtis. While conduction phenomena in gases was fairly well understood there was little exact knowledge and no satisfactory theory to cover conduction in liquid and solid materials.

PUNCTURE VOLTAGE AS A PRECISION MEASUREMENT

A very good paper dealing with methods of making puncture voltage tests and results obtained from many thousands of tests on condenser paper was presented by V. Bush and P. H. Moon. The test results showed the Wagner theory to be without much value.

A curve of puncture voltage against temperature was obtained for 0.0005-in. condenser paper in the range from − 2 deg. to + 130 deg. C. The puncture voltage was found to decrease uniformly at about 0.9 volt per degree Centigrade rise. Comparison of these data with the thermal theories of breakdown indicates that none of these punctures occurred according to the thermal theories, but were evidently of the disruptive type.

It was found that the puncture voltage measurements were distributed according to the normal law. A set of 8,800 readings with different-sized electrodes appears to support the weak-spot theory, though the evidence is hardly conclusive.

It was found that the inherent variability of the paper was not confined to causing variations from reading to reading, but also caused long-time variations from hour to hour and from day to day. This reduces the accuracy of the daily averages below the values that were predicted by the theory of probability.

An analysis of the results indicates that the variations from hour to hour and from day to day are largely due to variations in the paper itself. An investigation was made of the various possible sources of error, and it appears that no one of them could have caused an error of more than 1 or 2 volts. The probable error of the results is shown to be less than 1 per cent. This precision is evidently considerably higher than could have been obtained in the ordinary way without a great expenditure of time and labor.

Copper and brass electrodes are commonly used for puncture tests. Our experiments, however, indicate that with such electrodes there is a "seasoning" effect. This produces a marked change in puncture voltage unless the electrodes are cleaned after each puncture or are allowed to reach a steady state before readings are taken. Such a condition was obtained only after about 1,000 readings.

STRENGTH OF DIELECTRICS

A thoroughgoing treatment of the present knowledge and the missing knowledge regarding dielectrics was presented by W. A. Del Mar, W. F. Davidson and R. H. Marvin. Limitations of existing theories were pointed

POWER LOSS WITH DIFFERENT SPACINGS (STARR AND LLOYD)

ROUGHENED CONDUCTOR

Conductor:—0.365 in. diameter, polished.
Spacing:—63.5 in. to neutral.
Length:—10.0 ft.
Temperature: = 20 deg. C. Barometer 28.77 in. mercury. δ = 0.977.
Tube anode potential = 290.0 volts.
Ec = 87.0 kv. eff.

Kv. (Eff.) to Neutral	Rs (Ohms)	Power Loss (Watts)	
		Meas.	Calc.*
87.0	11,067	3.51	2.65
91.0	11,067	7.45	7.22
100.0	11,067	11.8	12.6
115.0	11,067	25.3	25.1
130.0	11,067	43.2	41.8
149.5	11,067	69.7	70.0

* Values calculated by means of Peek's formula (large wires) multiplied by 0.374 (m_0 = 1.00).

POLISHED CONDUCTOR

Conductor 0.365 in. diameter, polished.
Spacing:—21.5 in. to neutral.
Length:—10.0 ft.
Temperature = 18 deg. C. Barometer = 28.47 in. mercury. δ = 0.99
Tube anode potential = 290.0 volts.
Ec: Increasing voltage = 77.0 kv. (eff.). Decreasing voltage = 75.0 kv. (eff.).

Kv. (Eff.) to Neutral	Rs (Ohms)	Power Loss (Watts)	
		Meas.	Calc.*
75.0	5,040	8.57	15.1
85.0	5,040	35.4	31.5
90.0	5,040	42.3	42.0
100.0	5,040	70.3	67.5
115.0	5,040	118.0	117
130.0	5,040	177	180
150.0	5,040	283	285

* Values calculated by means of Peek's formula (large wires) multiplied by 0.73. (m_d = 1.00).

out and a fine presentation was made suggesting desirable researches.

Viewing the subject as a whole, while far from being on a satisfactory footing, either from the practical or theoretical standpoint, the developments of the last three years have given us a rough survey of the field with sufficient bench marks to enable us to visualize the general character of the intervening territory and to project our vision some distance beyond.

Research work can now be undertaken with an understanding of its significance in the general scheme of things, so that experimental work can generally be counted upon to have a broad as well as a specific significance.

This is a great advance over the empiricism of preceding years with its fragmentary and undigested data and crude theories.

Summarizing this report as a starting point for future research work, the present position with regard to solid and liquid dielectrics is as follows:

1. Dielectric failure is a phenomenon of circuit instability.

2. This instability results primarily from the form of the stress-current density curve, which has either an infinite or a negative slope in its upper ranges.

3. The explanation of this unstable characteristic is possibly to be found in the equilibrium conditions of free and combined electrons or other ions. In many cases these ions may be due to the presence of impurities in what we ordinarily consider to be the basic material.

4. A dielectric is not necessarily injured by operation at stresses corresponding to instability unless the entire circuit has unstable characteristics; hence this action is non-cumulative and reversible.

5. A dielectric under stress is subject to deterioration due to the energy of electric fields being destructively absorbed, in affecting chemical changes directly or by generating heat. This action is generally cumulative and irreversible.

6. In solids, practically every known instance of cumulative and irreversible deterioration seems to be traceable to the presence of gases or liquids, although it is conceivable that this phenomenon might even occur in a pure solid dielectric. In the case of liquids, it does not seem to be entirely dependent upon the presence of impurities, for there is considerable evidence of chemical changes of various types where hydrocarbons and similar liquids are used. No evidence is available as to the performance of liquids of simple molecular structure and consisting of one chemical element only, so that change is impossible.

7. The form of the time-dielectric strength curve is explained by both the reversible and the irreversible actions being at play, the former predominating for a short period and the latter for a long period.

8. There are indications that the cumulative deterioration in solids resulting from heat generated in the dielectric may be serious even for periods of less than a second in duration. In liquids no evidence of any kind having bearing on this point has been presented.

9. Attempts to frame a quantitative theory of dielectric failure in solids on the basis of heat generation and the negative temperature coefficient of resistivity which is characteristic of these dielectrics have not given quantitatively correct results.

10. The pyro-electric theory is not basically unsound but it will not be useful until it has been made part of a more general theory which must take many more factors into account.

11. The only theory approaching general application to explain dielectric failure of liquids assumes the presence of gaseous or vapor spaces within the liquids so as to permit the development of velocities sufficient to cause ionization by collision and the consequent production of additional ions as evidenced by increase in current.

12. A theory to explain the failure of dielectric liquids due to the presence of moisture has only limited application and cannot receive a serious place in this report.

13. Future progress is dependent largely on obtaining reliable data by carefully controlled experiments on a wide range of materials and carefully noting the influence of gaseous, liquid and solid impurities. These experiments should establish the relations between dielectric strength, thickness of dielectric, area of dielectric or form of electrodes, material of electrode, form of the voltage current waves, temperatures of dielectric and electrodes, mechanical pressure and other variable factors.

14. Various isolated phenomena should be carefully studied. These are likely to prove more valuable leads than phenomena that are better understood.

The last paper on the program dealt with mercury-arc rectifier phenomena and the author, D. C. Prince, explained the Calist theory of the arc phenomena and discussed "flash backs" and their prevention.

A vigorous discussion of insulation and dielectrics followed the presentation of these papers. While progress has been made the data available were shown to pertain to particular dielectrics and individual test conditions. Any general theory that satisfied general conditions was missing and individual data could not be reconciled. The composite dielectric made up of or-

Suggestions for Dielectric Research

Inconsistent experimental data and a lack of adequate theoretical explanations suggest the following lines of dielectric research:

Breakdown voltage and insulation thickness

Breakdown voltage and electrode form and material

Breakdown voltage and insulation area

Breakdown voltage and heterogeneity of dielectric

Breakdown voltage and temperature

Breakdown voltage and rate of variation

Breakdown voltage and pressure

Comparison of alternating and direct potentials

DISRUPTIVE, VISUAL CRITICAL AND CORONA VOLTAGES FOR SEVERAL CONDUCTORS (STARR AND LLOYD)

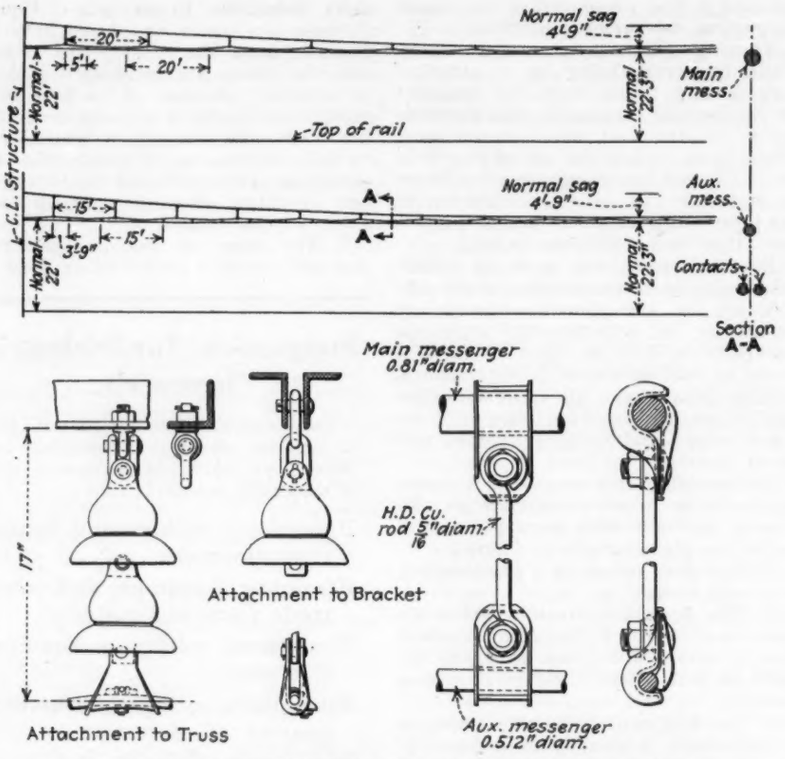
Conductor (Diam. In.)	Condition	Spacing to Neutral (In.)	*ed* (Kv. Eff.)		*md* (Actual)	*ev* (Kv. Eff.)		*ec* (Kv.)	δ
			Observed	Calc. (for *md* = 1)		Observed	Calc. (for *mv* = 1)		
0.015	Smooth	63.5	7.2	11.7	0.615	13.0	12.4	11.0	0.99
0.015	Smooth	7.5	6.5	9.12	0.710	10.0	9.65	9.0	0.99
0.064	Smooth	7.0	16.3	14.8	1.10	21.0	21.4	20.0	1.00
0.204	Smooth	63.5	41.5	40.0	1.07	62.0	61.5	59.0	0.99
0.204	Smooth	21.5	34.2	33.9	1.04	53.0	52.1	51.4	0.99
0.365	Polished	63.5	62.7	62.7	1.00	89.0	90.5	87.0	0.977
0.365	Polished	21.5	50.5	52.6	0.961	76.0	76.0	76.0	0.99
0.365	Rough	63.5	54.0	62.7	0.86	87.0	90.5	66.0	0.975
0.365	Rough	21.5	44.5	52.6	0.848	77.0	76.0	60.8	0.99
336,400 C. M.									
A. C. S. R.	Smooth	21.5	77.0	90.4	0.852	125.0	119.0	100.5	0.963
A. C. S. R.	Smooth	63.5	95.0	113.0	0.842	147.0	149.0	119.0	0.975
A. S. C. R.	Mutilated	63.5	.....	113.0	.....	.....	149.0	63.0	0.962
A. S. C. R.	"Weathered" (Rough)	63.5	.....	113.0	.....	.....	149.0	105.0	0.964

ed Disruptive critical voltage in Peek's formula. (= *eo*, practically, for conductors of diameter greater than 0.15 in.)
md and *mv* irregularity factors.
ev Visual critical voltage in Peek's formula. Observed value is that at which loss becomes quadratic.
ec Actual corona starting voltage.
δ Atmospheric correction factor.

ganic and inorganic materials has not been attacked successfully nor has a good general theory been developed. Fortunately for the art both cables and insulators have been developed by cut-and-try methods and have been improved by use of field experiences until they are very satisfactory. The discussion brought out many research suggestions in many dielectric fields.

Five Views on Railroad Contact Systems

"Current Collection from an Overhead Contact System Applied to Railroad Operation."
By S. M. VIELE, Pennsylvania Railroad.
"Catenary Design for Overhead Contact Systems."
By H. F. BROWN, New York, New Haven & Hartford Railroad.
"Catenary Construction for Chicago Terminal Electrification of Illinois Central Railroad."
By J. S. THORP, Illinois Central Railroad.
"Collection of Current from Overhead Wires."
By R. E. WADE and J. J. LINEBAUGH, General Electric Company.
"Railway Inclined-Catenary Standardized Design."
By O. M. JORSTAD, Westinghouse Electric & Manufacturing Company.



MAIN LINE CATENARY SYSTEM FOR ILLINOIS CENTRAL (THORP)

CATENARY construction for railway electrification featured one of the meetings held Friday morning. Another valuable paper on current collection from overhead contact systems was presented by S. M. Viele. Slow motion pictures which were taken by a camera with a speed of 800 pictures per second brought out details of current collection which proved to be very instructive.

The catenary design for the New York, New Haven & Hartford Railroad was described in a paper by H. F. Brown, and the construction for the Chicago terminal electrification was described by J. S. Thorp.

The loadings of each catenary system described by Mr. Thorp are shown in the accompanying table.

Valuable test data on current collection from overhead wires were given by R. E. Wade and J. J. Linebaugh.

Conservative evaluation of these tests and experience gained from operated lines indicate that 2,000 amp. or more can be successively collected, at any speed up to 60 or 70 miles per hour, with one pantograph, and 4,000 amp. with two pantographs.

These tests also demonstrate that it is practicable to design and construct an overhead contact and distribution system capable of delivering more than the amount of current required for train propulsion, with line potentials used to date for trunk-line electrification.

The type of suspension, connecting messenger or feeder messenger and contact wire or wires and its conductivity must be governed by the maximum current to be collected.

These tests and experience lead to the following approximate ratings for the types of construction given:

(a) Steel messenger, two 4/0 copper contact wires, loop hangers, feed taps spaced 1,000 ft., as used on Chicago, Milwaukee & St. Paul Railway:

Normal current, 1,000 amp., with a maximum of 1,500.

(b) Compound catenary with auxiliary feeder, messenger, loop hangers and feed taps spaced 300 ft.

Normal current, 2,000 amp., with a maximum of 2,700.

(c) For higher current value the frequencies of feeder taps must be increased in proportion to the current demand.

An interesting paper on standardized design for catenary systems was presented by O. M. Jorstad.

LOADINGS OF CATENARY SYSTEM (THORP)

Suburban Catenary System 70th-North	Equiv. Conductivity Circ.Mil.	Tension Still Air at 60 Deg. F., Lb.	Tension at 0 Deg.F. Ice and Wind, Lb.	Factor of Safety	Dead Weight	Dead Weight with Ice	Horizontal Wind Load. No Ice. 20-Lb. Wind	Horizontal Wind Load with Ice. 8-Lb. Wind
0.81-in. diameter composite messenger	370,000	7,750	12,350†	2.55	1.51	2.32	1.35	1.21
0.512-in. diameter. Copper auxiliary messenger	200,000	800	1,555	5.82	0.61	1.25	0.85	1.01
Two 3/0, 80 per cent conductivity. Bronze trolley wire	268,900	4,000	7,020	2.85	1.02	2.20	1.08	1.43*
Hangers					0.11	0.22	0.14	0.13
Total	838,900	12,550	20,925		3.25	5.99	3.42	3.78
Suburban Catenary System 70th-South, South Chicago and B. I. Railroads								
0.81-in. diameter composite messenger	370,000	7,720	12,325	2.55	1.51	2.32	1.35	1.21
0.375-in. diameter auxiliary messenger	105,500	800	1,555	3.55	0.32	0.87	0.63	0.92
Two 4/0 hard-drawn copper grooved trolley wires	423,200	4,000	7,020	2.2	1.28	2.51	1.21*	1.48
Hangers					0.15	0.27	0.18	0.15*
Total	898,700	12,520	20,900	....	3.26	5.97	3.37	3.76

*NOTE.—Wind on double trolley wires figures at one and one-half times the wind on one wire.

† Wind on messenger and one-half wind on hangers assumed as acting at point of support of messenger, remaining wind on catenary system assumed as acting at steady wire.

Letters from Our Readers

A Utility Company Executive Replies to Dealers' Criticism

To the Editor of the ELECTRICAL WORLD:

I am entirely in sympathy with the idea that light and power companies should try in every way possible to help dealers. By and large, we have wanted to help them for some years, but it has seemed impossible to put them on a footing where they would become merchants in competition with other merchants.

Your editorial entitled "The Dealers Criticise the Power Companies"* tars all central-station companies with the same brush. For instance, you say that ". . . The central stations, however, impelled by zeal to sell, are accepting often 10 per cent cash or less and taking contracts that frequently extend eighteen or twenty-four months or even longer." So far as department stores are concerned, I think we need not worry about them very much. They frequently adopt practices much more objectionable than any I have heard attributed to central stations. So far as the hardware dealers are concerned, they have just in recent years come into the retailing of electrical merchandise. I believe they should be encouraged in every possible way.

It seems to me it is well to recognize all of the facts. A statement of one of the principal manufacturers of electrical merchandise is to the effect that the hardware dealers handle very little of this merchandise, except in isolated cases, and that the majority of them handle only electric flatirons, making no attempt to broaden the sale of this line and doing no servicing whatsoever. I do not mean by this that we should neglect any opportunity that presents itself to assist that class of merchant to do a better job. The furniture dealer is another offender in many respects. He gives just as long-time payments as any one, if not longer. He sells a whole houseful of goods to a man, including electric appliances, and gives a very long time to pay, often at a very high cost to the purchaser. So you see we have offenders on all sides, and the only way we can accomplish anything is to keep closer together and discuss all phases of the problems presented, in order that we may correct evils where we find them.

Many central stations find their deferred-payment business very sound (the way they apply it), because they have interest charges covering these accounts that are ample but fair, considering the risk involved.

There is something very fundamentally wrong with the ordinary electrical dealer as we know him. Many intelligent men, over a long period, have been endeavoring to diagnose his case, without success. There are a few basic things that are wrong with him, and these points might better be discussed than simply to ramble around the subject, talking of too many indefinite things. For instance, we have not yet settled the point as to whether the electrical line is large enough to justify a man in going into the retail business. Are there enough purchases of any one electrical article in any community to permit a store of this character to operate at a profit? Price spread in this merchandise is now on a fairly reasonable basis as compared with other similar lines of merchandise. The hardware dealer, it may be pointed out, has a very distinct advantage, with the same price spread, because he has a very large line and sells many times a year to the same customer. All of this reduces his overhead. The hardware dealer can add a line of electrical merchandise without increasing his overhead to any appreciable extent.

Too few electrical dealers have had any experience whatever as merchants or even as salesmen. Many dealers start electric shops after having been in the contracting business in a small way for many years and are surprised that they are unable to make both ends meet. They know nothing of merchandising or selling methods; they do not know how to dress up their stores; they know nothing about window displays; they have had no experience in canvassing for the sale of articles in their neighborhoods; they have little or no knowledge of advertising. In fact, they are poorly equipped to carry on such a business.

I do not think the central-station people should be condemned for selling merchandise as they do until all the facts in each case are available. A clearing house is needed to which complaints can go for consideration and handling. There are plenty of districts throughout the country where no electric appliances would be sold if the central-station company did not do the selling. There are towns controlled by many of these new holding-company distribution systems in which the minimum bill of $1 is all they are able to get for electricity. In such an instance I submit that the sale of merchandise at almost any price would correct a bad situation. The demand of the rural community for electricity must be met, but it cannot be met by selling electricity at a loss. The only way such situations can be corrected is to induce the residents to use electricity-consuming devices that will give them a service for which they are willing to pay. Inducements in the selling of appliances in such towns are on almost the same plane as was our effort to get the public to use the electric flatiron twenty-five years ago. Numerous towns exist where the conditions are as I have related —where there is no hardware store, the only store being the general store, which is not concerned in anything that the public knows nothing about or that it itself feels the public is not interested in. In many of these towns there are people who do not use 15 kw.-hr. a month.

This long letter is sent in an effort to point out that there are several sides to the merchandising problem. In the large metropolitan center conditions are entirely different from those in the very small farming community, and those in business in these larger centers should recognize that fact. In our fair-sized cities and towns it may be even necessary to subsidize the dealer long enough to get him started on the road to prosperity. If the spread in this class of merchandise were 100 per cent, it would not make for profitable operation in some localities. When we reach the point where the public looks upon domestic appliances electrically operated as absolute necessities, we shall not hear much about this situation, because it will adjust itself on an economic basis. Until then, however, we must study the actual conditions, keep them as straight as possible, and do what we can to improve our trade relations.

E. W. LLOYD,
Vice-President.
Commonwealth Edison Company,
Chicago, Ill.

*ELECTRICAL WORLD, March 12, 1927.

Central Station and Industrial Practice

Timing Method for Meter Laboratories

BY O. K. COLEMAN
American Gas & Electric Company, New York City

PRACTICALLY all electric utilities maintain a definite test schedule for watt-hour meters. It is the general practice to test them by comparison with a rotating standard. The testing of these secondary standards at once becomes the biggest job of the meter-standardizing laboratory. Meters of this type, although fairly rugged, are subject to rather rough treatment, and experience has shown that they should be tested at least once every two weeks.

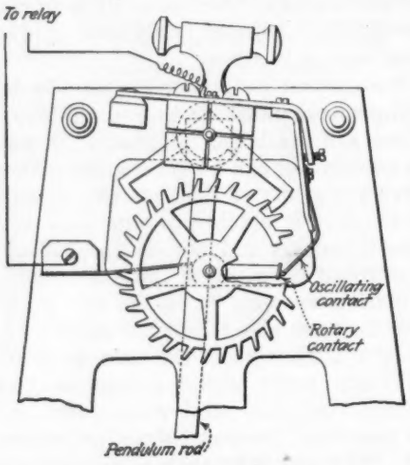


FIG. 1—CONTACT DEVICE IN MASTER CLOCK FOR SECURING DEFINITE TIME INTERVALS

No gearing is necessary. One contact is mounted on the escapement wheel and the other is mounted so that it oscillates simultaneously with the pendulum, thereby making a brushing contact for every 60 beats of the pendulum. It is self-evident from the arrangement that the contact is made and the impulse sent with the pendulum in the same position each time, therefore giving exactly 60-second intervals. Two sets of these contacts are installed on each clock, and if desired one set may be used to operate secondary clocks.

A simple, direct method of testing rotating standards and the one in general use is by comparison with a laboratory standard wattmeter, holding a constant load on the wattmeter, either running the rotating standard a number of revolutions and measuring the time of running for a definite time interval and making a note of the number of revolutions.

Precision methods of measuring time intervals are elaborate and expensive. Practical methods commonly used, such as the stop-watch, are rather inaccurate due to large personal errors as well as considerable inherent errors. The ordinary stop-watch measures only to 0.2 of a second, causing an error* of one-third of 1 per cent per division on runs of 60 seconds' duration. This is the approximate duration of the usual test run on a rotating standard. If a stop-watch is used, it calls for an additional man in making a test, since one man's time is required to observe the wattmeter and hold the load constant.

By applying potential to the meter under test automatically for a definite time interval the error due to time measurement can be greatly reduced. Definite time intervals can be secured in a number of ways. There are precision methods of time measurement that would be applicable, but, as mentioned before, they are impractical. A practical means and one that has been used by our company as well as some others for a number of years is the use of a 60-beat pendulum self-winding master clock fitted with a contact device to give impulses at definite intervals. The impulses from this clock operate a relay which closes and opens the potential circuit to the rotating standard under test.

This timing method has two controlling factors, the accuracy of the contact device and the workability

*An article entitled "The Limitations of the Stop-Watch" in the *Journal* of the A.I.E.E., Feb. 18, 1921, by A. L. Ellis, presents a complete discussion of this subject.

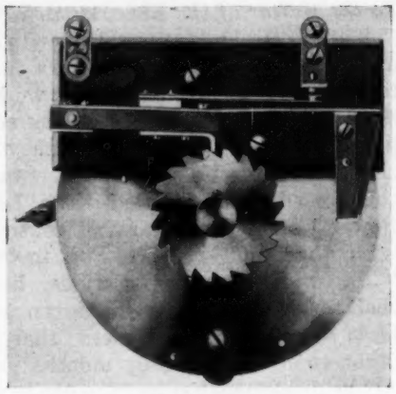


FIG. 3—MAKE-AND-BREAK RELAY ACTUATED BY IMPULSES FROM MASTER CLOCK

The operating voltage may be 12, 16 or 24 volts direct current. This supply may be furnished by an open-glass-jar storage battery and a compact "Rectigon" charging panel, and an automatic charging device. The energy for operating the master clock, secondary clocks, automatic program signals and any recording devices may be taken from this same supply. On installations where there are not more than two secondary clocks and these are located near the master clocks, a 6-volt supply is furnished by a 35-amp.-hour storage battery and a commercial trickle charger. The contacts in the relay are designed for a maximum capacity of 50 volt-amp., 440 volts, making it possible to test rotating standards of voltages as high as 400 volts without the use of auxiliary equipment. The operation of the relay is briefly as follows: A low-voltage direct-current solenoid operated by an impulse from the master clock actuates a camwheel, moving it one-half the length of a tooth for each impulse. One end of a lever resting on the cam rises and falls, alternately opening and closing the potential circuit to the rotating standard under test.

FIG. 2—MASTER CLOCK FURNISHES DEFINITE TIME INTERVALS FOR METER LABORATORY

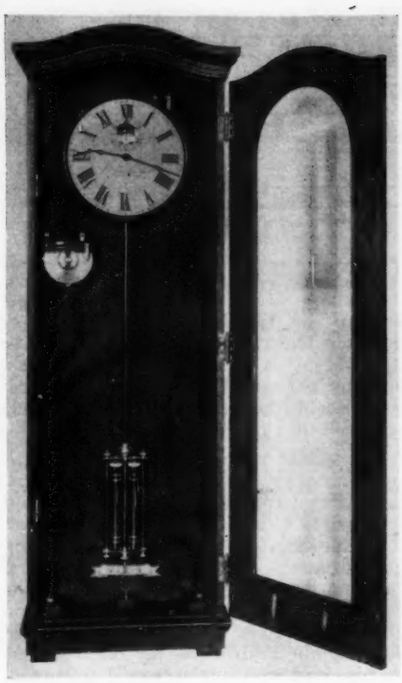


FIG. 4—THE RELAY CAN BE MOUNTED INSIDE THE CLOCK CASE OR IN A STEEL BOX

of the relay. The clocks themselves are guaranteed by the manufacturers to be accurate within 10 to 30 seconds per month, depending on the class of clock used. The percentage of error per minute due to the clock would be infinitesimal when within these values. The most important point is to get a contact device that is absolutely positive in action, and since it is impractical to incorporate the necessary on-and-off feature into this contact device, the next step is to get a suitable relay.

Heretofore there has been nothing on the market for this particular work and every laboratory has been compelled to make up its own apparatus, which, though good in principle, was sometimes faulty in operation and usually very expensive. The Standard Electric Time Company, Springfield, Mass., recently worked this scheme out for us and we are now able to equip our laboratories with accurate time devices for a cost of little more than one good stop-watch.

A control button and switch are put within reach of the tester so that the potential supply to the rotating standard can be controlled at will. A diagram of connections is shown. The procedure for test is:

1. Close the potential to rotating standard by pushing control button.
2. Check direction of rotation and set load to desired value.
3. Open the potential circuit to the rotating standard by again pushing control button.
4. Read or reset rotating standard to zero.
5. Hold load constant at desired value until the circuit is closed by the clock, a run of 60 seconds made and the circuit opened, again by the clock.
6. Enter reading of standard on test card or data sheet.
7. Close the potential circuit again, make necessary changes in load and proceed as before.

From experience it has been learned that the one-minute interval between tests is just about the right amount of time required to make the necessary notes of the test and readjust load for the following run. On a rotating standard with five current coils about ten different test runs could be made in just twenty minutes.

The definite time interval device is by no means limited to this class of testing and many other applications may be found.

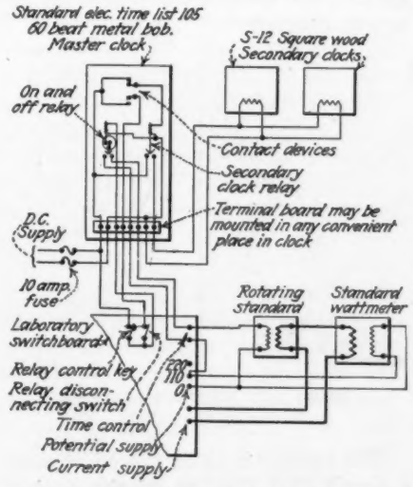


FIG. 5—SCHEMATIC CONNECTIONS FOR UTILIZING DEFINITE TIME INTERVAL SERVICE IN TESTING ROTATING STANDARDS

Definite-Time Relay Speeds Production

BY E. A. SWIEDOM
General Electric Company

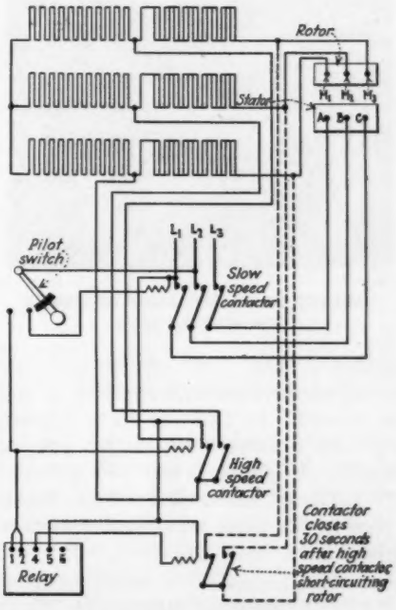
IT WAS desired to decrease the time required for acceleration of a slip-ring motor driving a White centrifugal machine at the American Beet Sugar Company's plant in Mason City, Iowa, and thus increase production.

As originally installed this machine was driven by a 40-hp. induction motor with control manually operated and arranged to give two speeds. When the pilot switch was moved to the first point, a contactor closed, starting the motor with all the resistance in the rotor circuit.

After the machine was filled, the pilot switch was advanced another point, which closed a second contactor, short circuiting a section of the resistance and accelerating the unit to full speed. With this arrangement of control it required approximately 100 seconds to attain full speed.

By shifting the secondary leads so as to leave less resistance in the circuit after closing the high-speed contactor it was found that the acceleration was materially increased, but at the expense of higher demand peaks. To obviate this yet still secure an increased rate of acceleration a third contactor was installed. This contactor short circuits all of the rotor resistance and is operated by a definite-time relay. By experiment it was found that after running with the high-speed resistance in the circuit for 30 seconds the resistance could be shorted out without appreciable disturbance to the line, and full-load speed obtained within 35 seconds, saving 65 seconds per machine cycle. Since this sugar machine makes twenty complete cycles an hour, this saving represented an appreciable increase in production.

The installation has successfully gone through one season, was easily applied, has given no trouble and required no attention.



CONNECTIONS FOR DEFINITE-TIME RELAY IN MOTOR CIRCUIT

Meter-Parts Cabinet Used by Southern Power

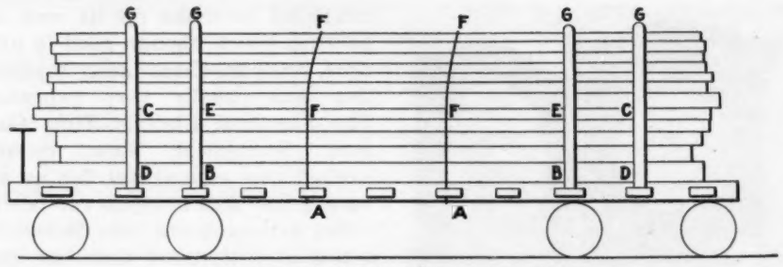
HOW to keep meter parts conveniently is frequently a problem to metermen. The manner in which this is done by the meter department of the Southern Power Company is shown in the accompanying illustration. This cabinet, which is about 6 ft. high, is built in two

CABINET WITH 130 COMPARTMENTS FOR METER PARTS

sections, the top section being mounted on bearings so that it can be turned. In the top section there are 112 drawers, while the bottom has 18. In all there are 130 drawers of various sizes, the sizes being given in the table which accompanies this article.

DIMENSIONS OF DRAWERS IN METER-PARTS CABINET

Number of Drawers	Width, In.	Height, In.	Depth, In.
Side No. 1—Top Section			
7	5⅜	6	4½
7	7⅜	6	4½
14	4	2⅞	4½
Side No. 2—Top Section			
7	6	6	12
7	7	6	5½
14	4⅞	2⅞	5½
Side No. 3—Top Section			
7	5⅜	6	12
7	7	6	5½
14	4⅛	2⅞	5½
Side No. 4—Top Section			
7	6⅜	6	11
7	6¼	6	15
14	4	2⅞	5
Side No. 1—Bottom Section			
9	8⅛	6	9
Side No. 2—Bottom Section			
9	8⅛	6	18



METHOD FOR SAFELY UNLOADING POLES

Precautions to Assure Safe Unloading of Poles

TO INSURE the greatest degree of safety to men unloading poles from railroad cars the following rules have been adopted and are enforced by the Wisconsin Power & Light Company:

Avoid going on top of load and do not cut top wire (*G*).

If a load of poles leans, unloading should be in the same direction that it is leaning. If the track and storage yard arrangement is such that this is not possible, strong props must be placed against the load on the leaning side.

Attach two strong ropes—1 in. or more—to pockets at *A*, throw the other end of ropes over car as at *F*, pull up so they are taut and snub to substantial anchors some distance away from the car in such a manner that the ropes can be gradually released. The free or loose ends must be laid out smoothly so they will not become knotted or tangled in one's feet or hands. The ropes will not be effective if snubbing is done at opposite pockets or near the car. The following operation should then be carefully performed:

1. Cut the two inside stakes at *B*.
2. Cut the wires at *E*.
3. Cut the outside stakes at *D* so that they are free at the pockets but both wires *C* are still intact.
4. Cut center wires *C* with long handle axe. As soon as wires at *C* are cut the load will shift and the person doing the cutting should stand at end and out of the way as much as possible and have no obstructions in his way so that a rapid get-away may be assured.
5. Release the snubs gradually until the poles reach the ground.

It is sometimes desirable to have skids on the unloading side to enable the poles to be moved away from car more readily. These skids may be made of other poles or other heavy timber. The skids must be supported in at least two places in between the end supports to avoid breaking them when loads come on them.

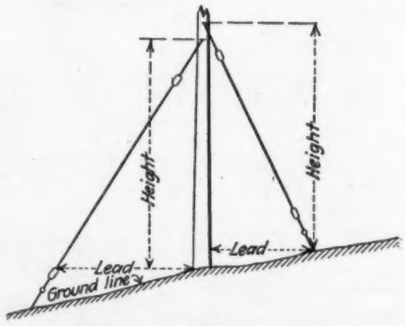
Rural-Line Specifications—VI

Of the Wisconsin Power & Light Company

Anchors

ANCHORS shall be located, when possible, near property lines or line fences and away from traveled paths or roadways. All anchor rods are to be ⅝-in. 6-ft. galvanized, attached to either an 8-in. cone anchor or an 8-in. wing anchor. In marshy line, where sufficient weight and resistance cannot be secured with patent anchors, a cedar log 4 ft. long by 8 in. diameter is to be used. Where the anchor location with respect to the pole is such that the "lead" is less than the "height," patent anchor holes shall be bored in line with the point where guy is attached to the pole. When the "lead" is more than the "height," the patent anchor hole is to be dug at an angle of 45 deg., and in order to bring the rod in line with the point of guy attachment a trench should be dug for the rod before anchor is expanded or covered with rock and tamped. An illustration of "lead" and "height" is shown on the drawing.

The 8-in. cone anchor requires approximately ¾ bushel of 1½ in. to 2 in. diameter stone, placed on the top of the anchor in small lots around anchor and care taken that each lot is well tamped.



LEADS AND HEIGHTS OF GUYS

The anchor is to be placed at such a depth that the top of the anchor rod eye will extend not less than 6 in. nor more than 10 in. in line with the rod, above the ground.

Commercial Activities and Public Relations

Commercial Refrigeration on Off-Peak Rate*

THE Merchants Refrigerating Company, along with one other concern, was the first to have contracts in New York City under the present so-called off-peak power load. The rate in this contract was patterned after that of the Commonwealth Edison Company in Chicago, but differed in that the charge was based entirely on a demand basis, rather than on an energy basis. The charge is based on a weekly demand, the highest demand for a 15-minute period being the basis of calculation. This New York contract required that the consumer should not use less than 20 per cent of maximum demand of the preceding summer during the months of October, November, December and January between the hours of 4 and 8 p.m.

There are many features of electric driving that are advantageous in plants in a large city. Saving of space is a considerable item, particularly where real estate values are high. The space occupied by a steam plant with necessary coal bunkers is clearly in excess of the space required by an electric drive with purchased current. The first cost of electric plants is lower than that of any other type of drive, and in the opinion of many the maintenance is lower. The cost of operation, all things considered, has been found by this company to be lower than that of a steam plant and is on theoretical calculations lower than any other type of drive that might be installed in New York City. The synchronous motor found many objectors in the early days on account of its limitation to a single speed. This objection has led to the development of capacity control in the compressor. Clearance pockets have been employed to reduce the actual amount of vapor compressed and delivered. Arrangements of clearance pockets have proved most satisfactory and are used quite generally in both air and ammonia construction. Two and three-speed synchronous motors meet the demand for speed variation.

One of the developments not generally understood is street pipe line refrigerating in large cities. Here in New York City a street pipe line supplies refrigeration from the power houses of the Merchants Refrigerating Company embracing mains and branches extending from Varick Street and Hudson Street on the east to West Street, and from North Moore Street to Murray Street on the south. The territory supplied contains the largest wholesale and food commission business in the world. The refrigerating load on this street pipe line amounts to 600 tons of refrigeration in the summer time. The total space cooled is approximately 2,000,000 cu.ft. A brine system is used in this pipe line, the largest mains being 12 in. in diameter, laid in the streets with necessary expansion joints and connections to the various properties served.

Many new uses for refrigerating are being found. Chemical processes involving low temperature are daily being developed. One of the largest refrigerating plants in the world is that of the Eastman Kodak Company, using refrigeration in connection with the production of films. The manufacture of carbon paper, ice cream, rubber, candy and textiles offers fields in which the future of refrigeration may expect increasing development.

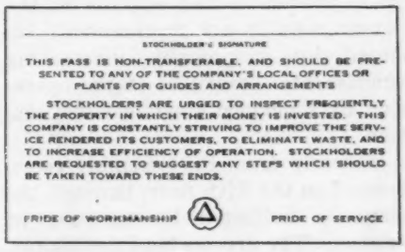
*Excerpts from talk by G. A. Horne, chief engineer Merchants Refrigerating Company, before Interstate Power Club, New York, May 10, 1927.

Valmont Station Caters to Visitors

THE Valmont steam plant of the Public Service Company of Colorado, located at Boulder, Col., is fully equipped to play host to lawn parties, dancing parties and inspection parties. During the past few months many clubs, civic organizations and societies have been invited and have accepted the invitation to hold regular meetings at this plant. In addition to this the tourist season attracts thousands of people to Colorado and incidentally to Valmont, where a modern plant may be seen in operation.

VISITORS WELCOME
VISITING HOURS
—8 A.M. TO 4 P.M.—
TAKE ELEVATOR TO FIFTH FLOOR TO START TOUR OF PLANT.
LADIES REST ROOM 3RD FLOOR.
ELEVATOR IS AUTOMATIC.
SEE DIRECTIONS AT ELEVATOR DOOR
ALL WIRES & APPARATUS ARE TO BE CONSIDERED DANGEROUS
DO NOT HANDLE.
WATCH YOUR CHILDREN.
Our Motto— Courtesy To You.

VISITORS ARE MADE WELCOME BY SIGN AT PLANT ENTRANCE

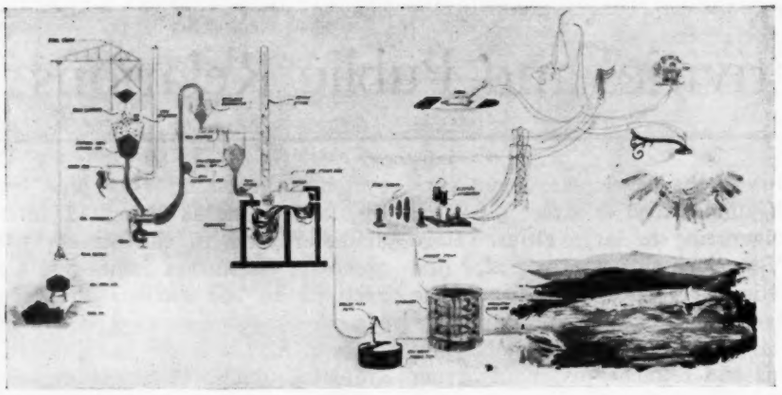

STOCKHOLDER'S SIGNATURE
THIS PASS IS NON-TRANSFERABLE, AND SHOULD BE PRESENTED TO ANY OF THE COMPANY'S LOCAL OFFICES OR PLANTS FOR GUIDES AND ARRANGEMENTS
STOCKHOLDERS ARE URGED TO INSPECT FREQUENTLY THE PROPERTY IN WHICH THEIR MONEY IS INVESTED. THIS COMPANY IS CONSTANTLY STRIVING TO IMPROVE THE SERVICE RENDERED ITS CUSTOMERS, TO ELIMINATE WASTE, AND TO INCREASE EFFICIENCY OF OPERATION. STOCKHOLDERS ARE REQUESTED TO SUGGEST ANY STEPS WHICH SHOULD BE TAKEN TOWARD THESE ENDS.
PRIDE OF WORKMANSHIP
PRIDE OF SERVICE

STOCKHOLDERS' PASS ISSUED BY PUBLIC SERVICE COMPANY OF COLORADO

On the reverse side of the card is a statement to executives and department heads signed by the vice-president and general manager of the company requesting them to show holder every courtesy.

The gate entrance is made attractive by its construction of native rock and covering of flowers. Inside is a mound planted with flowers to spell out the words "Public Service." In the evening the grounds are brilliantly illuminated by an array of floodlights powerful enough to attract attention five miles away.

Visitors are made to feel at home by a large "Visitors Welcome" sign on the station door leading to the elevator. Here they also are given a chance to register and leaf the records in hopes of finding a familiar name. Any party can proceed through the complete plant without any assistance if it will read the few directions given and follow the arrows. If, however, a guide is desired, it is necessary only to apply at the chief engineer's office, and a compe-



LARGE COLORED DRAWING SHOWS GRAPHICALLY FUNDAMENTAL PRINCIPLES OF PLANT OPERATION

tent guide will be provided. The elevator is so simple and safe to operate that accidents are considered hardly possible.

The principal operations of the plant are shown in a homely fashion by a large-scale, colored drawing in the assembly room of the plant. It attracts the interest of all visitors and is of greater educational value to many than is the trip through the plant. By blending colors it has been made attractive and appeals to the person who is not mechanically inclined by graphically illustrating fundamental principles in the operation of a modern steam-electric station.

The trip from the assembly room, located on the fifth floor, through the plant is indicated by the use of arrows. The arrows lead the visitor, without retracing steps through the control room, over three levels of the boiler room, including the firing platform, coal-crushing mill, machine shop, pump and condenser level of generator room, and main generator floor. Other features, such as the hoisting crane, white heat in the firebox, immense quantity of water required for condensation and generally clean and neat condition of the plant, leave the visitors with a more kindly spirit toward public utility problems.

An annual pass, illustrated herewith, is given to all stockholders each year and entitles them to the privilege of inspecting all plants, equipment and properties of the utility company.

New "Movie" Serves as Peg for Utility Publicity

BY C. W. ORGAN
General Superintendent Electric Department, Illinois Power Company, Springfield, Ill.

THE part that central stations take in the operation and erection of the hundreds of new theaters that are built each year is usually unknown to the general public. The opportunity to exploit this important rôle was not overlooked, however, by the Illinois Power Company when the new Orpheum Theater was recently added to Springfield's places of amusement.

Full-page spreads were published in the local newspapers on the two days preceding the opening, under the forceful captions: "The Power Behind the Screen" and "Around the World on a Beam of Light." The first advertisement consisted of a large photo of the completed theater, two views of the theater's underground substation, one of the company's 45,000-hp. substations, through which current is delivered to the theater, and a view of the local steam plant. Explanations below the illustrations pointed out that the lighting requirements are equivalent to those of a city of 5,000, while the power requirements are equivalent to those of operating one-half of Springfield's street cars.

The other spread included another view of the completed theater and two interior views. The accompanying text was chiefly of an educational character or expressed appreciation to organizations which made the theater possible. Emphasis was placed on the countless tasks that electricity performs inside and outside the theater.

FLOWER BED SPELLS "PUBLIC SERVICE" AT VALMONT STEAM PLANT

Electric Utilities' Service Most Advanced

LESS than twelve out of every 100 homes in Ohio towns or cities are without electric lights, according to a survey just made in 58 communities by the Ohio Federation of Women's Clubs. The survey shows that 48.8 housewives out of each 100 iron with electricity.

The federation survey, so conducted as to be representative, took in communities by groups, ranging in population from less than 1,000 to more than 100,000. Electricity is available in 57 out of the 58 communities studied. The only one lacking it is a village of less than 500 population.

The conveniences of electricity, it was noted, have been extended much more widely than certain others, such as public water supply, public sewage disposal and regularly organized collection of garbage and rubbish. Ten out of 25 cities of less than 5,000 population have no public water supply, and eighteen out of 33 cities having a population of 10,000 or less have no public sewage disposal system.

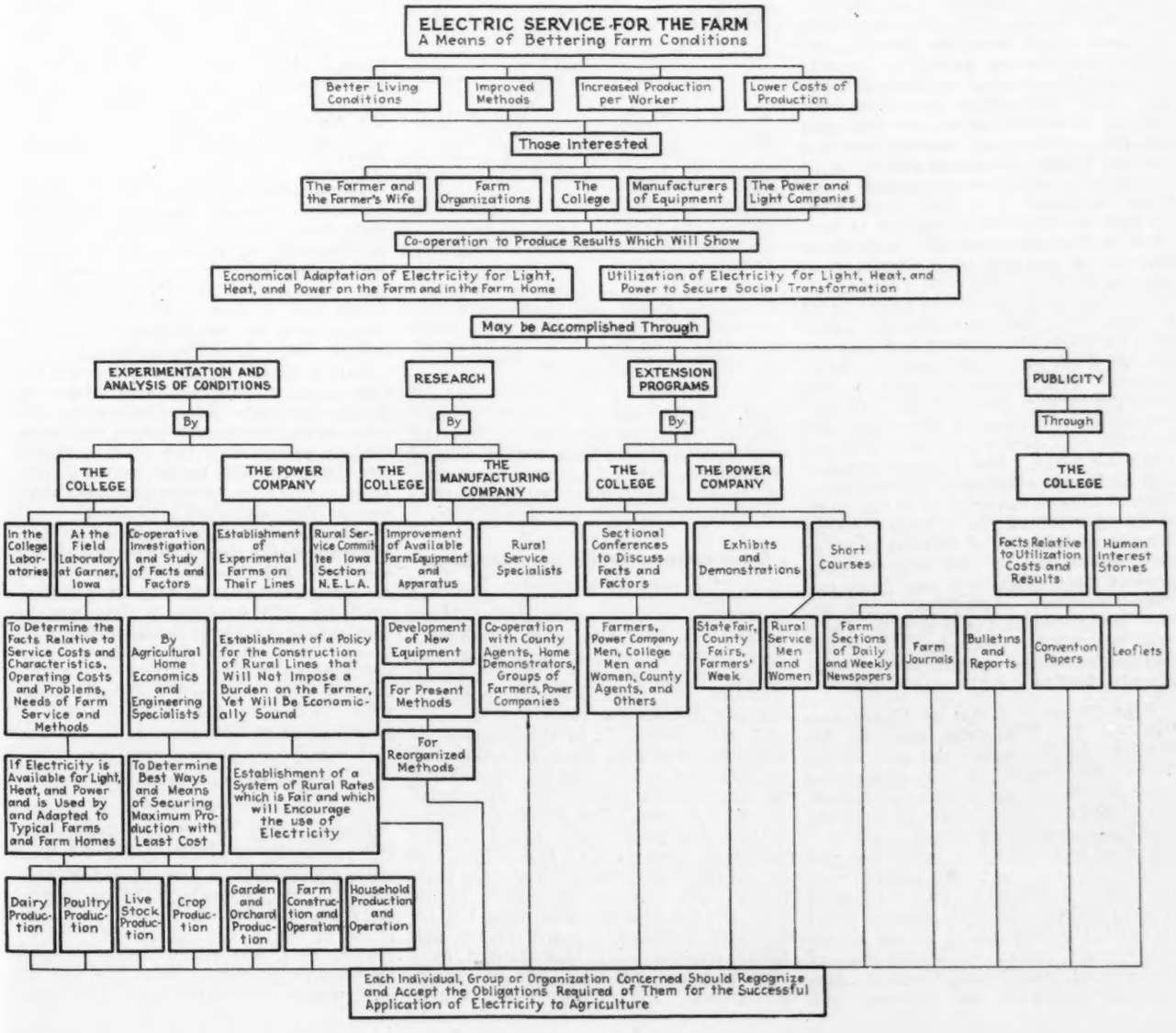
In studying the uses to which electricity is put it was found that the electric washing machine is noticeably gaining in popularity. Even in towns of 1,000 or less, fifteen out of each 100 homes have electric washers. In the largest cities this percentage has grown to 31.

Ohio ranks high in the use of electric vacuum cleaners, having 55 in each 100 homes included in the survey. Electric ranges are coming into increased use, as are electric sewing machines, electric ironers, electric refrigerators and electric water heaters.

In the smaller communities it is encouraging to note no lack of facilities that sometimes are thought of as confined largely to the cities. In the use of electric irons, for instance, the towns of 10,000 to 25,000 lead all the rest, having in some instances 64 irons for each 100 homes. The use of the electric light, it was found, also ran high in many of the smaller places. Wyoming, in Hamilton County, led all the rest in this regard, being able to boast that virtually every dwelling in the town of 2,500 inhabitants has them.

Iowa Program for Rural Electrification

THE accompanying chart shows rural service benefits and responsibilities and the manner in which the interested agencies, cultural and economic, may combine and work toward a solution. The plan outlined is the conception of Frank D. Paine, professor of electrical engineering, Iowa State College, Ames, Iowa, and supervisor of the state rural electrification project at Garner, Iowa.


ELECTRIC SERVICE FOR THE FARM
A Means of Bettering Farm Conditions
Better Living Conditions
Improved Methods
Increased Production per Worker
Lower Costs of Production
Those Interested
The Farmer and the Farmer's Wife
Farm Organizations
The College
Manufacturers of Equipment
The Power and Light Companies
Co-operation to Produce Results Which Will Show
Economical Adaptation of Electricity for Light, Heat, and Power on the Farm and in the Farm Home
Utilization of Electricity for Light, Heat, and Power to Secure Social Transformation
May be Accomplished Through
EXPERIMENTATION AND ANALYSIS OF CONDITIONS
RESEARCH
EXTENSION PROGRAMS
PUBLICITY
By
By
By
Through
THE COLLEGE
THE POWER COMPANY
THE COLLEGE
THE MANUFACTURING COMPANY
THE COLLEGE
THE POWER COMPANY
THE COLLEGE
In the College Laboratories
At the Field Laboratory at Garner, Iowa
Co-operative Investigation and Study of Facts and Factors
Establishment of Experimental Farms on Their Lines
Rural Service Committee Iowa Section N.E.L.A.
Improvement of Available Farm Equipment and Apparatus
Rural Service Specialists
Sectional Conferences to Discuss Facts and Factors
Exhibits and Demonstrations
Short Courses
Facts Relative to Utilization Costs and Results
Human Interest Stories
To Determine the Facts Relative to Service Costs and Characteristics, Operating Costs and Problems, Needs of Farm Service and Methods
By Agricultural Home Economics and Engineering Specialists
Establishment of a Policy for the Construction of Rural Lines that Will Not Impose a Burden on the Farmer, Yet Will Be Economically Sound
Development of New Equipment
For Present Methods
For Reorganized Methods
Co-operation with County Agents, Home Demonstrators, Groups of Farmers, Power Companies
Farmers, Power Company Men, College Men and Women, County Agents, and Others
State Fair, County Fairs, Farmers' Week
Rural Service Men and Women
Farm Sections of Daily and Weekly Newspapers
Farm Journals
Bulletins and Reports
Convention Papers
Leaflets
If Electricity is Available for Light, Heat, and Power and is Used by and Adapted to Typical Farms and Farm Homes
To Determine Best Ways and Means of Securing Maximum Production with Least Cost
Establishment of a System of Rural Rates which is Fair and which will Encourage the use of Electricity
Dairy Production
Poultry Production
Live Stock Production
Crop Production
Garden and Orchard Production
Farm Construction and Operation
Household Production and Operation
Each Individual, Group or Organization Concerned Should Regognize and Accept the Obligations Required of Them for the Successful Application of Electricity to Agriculture

Digest of Electrical Literature

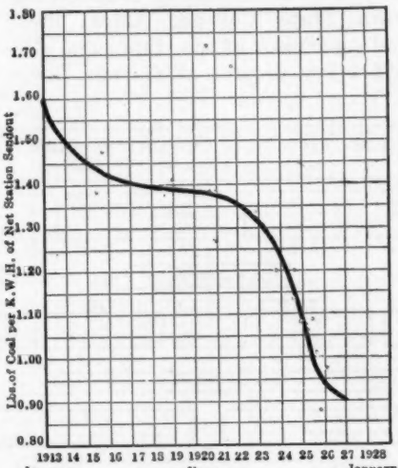
Hydro-Electric Development and Steam Equipment

Kip's Bay Plant of the New York Steam Corporation.—With an installed capacity of 1,000,000 lb. of steam per hour, this new station will supply steam for heat and power in the uptown district. Eventually, it will contain twelve units with a total capacity of 4,000,000 lb. of steam per hour. Owing to high land values, the plant is designed to give high capacity per square foot of floor area. Boiler, economizer and air heater compose a single unit with a total surface of 71,682 sq.ft. Steam is generated at 275 lb. and discharged through reducing valves to the distribution system at 150 lb. The guaranteed efficiency of each unit is 88 per cent at 325,000 lb. of steam per hour.—*Power*, May 31, 1927.

Powdered Coal and Gas Cleaning.—This article deals primarily with the production of powdered coal used as boiler fuel and with the gas-cleaning plant of the Colorado Fuel & Iron Company, Pueblo, Col. The gas-cleaning plant, which is on the Cottrell electrical precipitation principle, permits the blast-furnace gas to retain its sensible heat and thus conserves fuel. Electric precipitation of the dust and the gas consists of passing the gas through tubes or between partitions in the center of which are suspended small wires insulated from them. A high-voltage, uni-directional current is supplied to the wires, and the particles of dust in the gas pick up a charge when passing through this zone and are deposited on the walls of the partition as a result. At regular intervals, about once an hour, the current and gas are cut off from each unit and the tubes rapped. This causes the dust to drop into the lower part of the cleaner, whence it is discharged into a bin and into railroad cars which take it to the sintering plant. The original installation at Pueblo consists of sixteen units. Each unit has a capacity of 10,000 cu.ft. of gas per minute, or a total capacity for the installation of 160,000 cu.ft. of gas per minute at 380 deg. F. The present unit cleans the gas from two blast furnaces. Additional units are now being installed which will give a total capacity for this plant of 360,000 cu.ft. of gas per minute.—*Iron Age*, May 19, 1927.

High-Pressure Steam at Edgar Station.—I. E. MOULTROP and E. W. NORRIS.—In this paper the authors describe the design of the generating plant for the Edison Electric Illuminating Company, using steam at 1,200 lb. The equipment of the original plant is described and operating difficulties and results are discussed. An extension to the station is described, and the results of experiences with the original plant as applied to the design of the extension are set forth. As in the case of the original installation, the plant layout and equipment are described and operating results given. The capacities of the boilers, turbines and auxiliaries are added. A discussion of the possibilities of pressures above 1,000 lb. is included, as well as some of the problems likely to be encountered in high-pressure service equipment. The inadequacy of existing data is mentioned, and the paper closes with a comparison of the space requirements of high-pressure and low pressure equipment.—*Paper presented before American Society of Mechanical Engineers, White Sulphur Springs, W. Va.*, May 23, 1927.

Present Tendencies of Steam-Station Design.—V. E. ALDEN.—This paper reviews the progress made in recent years in steam-station design and discusses higher steam pressures and temperatures, the use of economizers, effect of stage bleeding for feed-water heating and turbine design, use of air preheaters, furnace design, improved methods of burning coal and proposed increase in size of equipment, concluding with a résumé of future possibilities in this field.—*Mechanical Engineering*, June, 1927.



PERFORMANCE OF TYPICAL STATIONS PLOTTED AGAINST DATE OF INITIAL OPERATION OF STATION

Generation, Control, Switching and Protection

Heating of Conductors Under Short Circuit.—G. GUT and L. M. GRUNBERG.—In power systems of large capacities short circuits of only a few seconds' duration may raise the temperature of the affected loop far beyond permissible and safe limits. It is the purpose of this article to give exact formulas and to construct curves for the calculation of temperature rises under such brief excess currents. The authors' computations are particularly based on the following three facts: (1) All heat is stored and heat conduction may be neglected; (2) specific resistance varies with the temperature and must not be assumed constant if grave errors are to be avoided; (3) short-circuit current is not a constant, but gradually diminishes. The derived formulas and curve sheets are explained with three examples taken from power house-practice.—*Bulletin de l'Association Suisse des Electriciens*, Vol. IV, 1927.

Transmission, Substations and Distribution

Portable Cable-Testing Outfit. — H. MEHLHORN. — After explaining the various disadvantages of testing installed underground cables with high-voltage alternating current or with high-voltage mechanically rectified direct current, the author describes a modern type of high voltage direct-current outfit in which a vacuum-type rectifier is used in conjunction with a small transformer. The essential parts of the portable equipment are a 3-kva., 16,000-volt, single-phase, oil-insulated transformer, a small regulating auto-transformer, a two-electrode rectifier tube, a filament transformer and the necessary measuring instruments. An exceedingly fine regulation in steps of 0.1 per cent can be obtained from zero to the maximum high voltage. The entire apparatus is installed in a small trunk. For testing in remote places where no alternating-current power supply is available a portable generator driven by a 3-hp. gasoline motor is available. For large power companies, where a self-maintained cable-testing set is frequently required within a wide area, the generator and the testing set can be conveniently mounted on a small automotive truck, with sufficient room for four men and the necessary tool equipment.—*Siemens Zeitschrift*, April, 1927.

Manufacturing of Modern High-Voltage Cables.—B. ELL.—A very complete description of the history and the development of cable manufacturing, with a detailed discussion of the existing theories of insulation strength, losses and modern methods of manufacturing.—*Teknisk Tidskrift, Elektroteknik*, April 2, 1927.

Safe Practices in Connection with the Operation of High-Tension Power.—T. E. HUGHES.—After indicating the principal differences between the high-tension systems in the steel industry and those in the public utilities, the author proceeds to analyze the basic causes for electrical industrial accidents. He lists them as follows: (1) Ignorance, (2) haste, (3) dependence on others, (4) thoughtlessness, (5) lack of discipline, (6) defects in physical condition, (7) inadequate illumination. The author considers the importance of these various causes of accidents to be sufficient to justify detailed discussion, and he presents a few accident examples illustrating the various items.—*Iron and Steel Engineer*, June, 1927.

Units, Measurements and Instruments

Measurement of Sheath Losses in Cables. — R. A. BROCKBANK. — The author describes a simple, quick and accurate bridge method of measurement for the determination of sheath losses in single-core cables. He enumerates, first, the many disadvantages he believes connected with the use of electromagnetic wattmeters for such

measurements and lists them as follows: (1) Corrections due to the phase angles of the two coils; (2) very low sensitivity with small currents and relatively short lengths; (3) necessity for an absolutely constant voltage supply; (4) necessary arrangements for giving various current ranges; (5) accurate calibration of voltmeters and ammeters in conjunction with their leads; (6) interpolated resistance readings between each wattmeter reading due to the change in resistance caused by the large currents. The remainder of the paper consists of a detailed enumeration of the steps necessary to determine the losses by the method proposed by the author.—*Electrical Review (England)*, May 13, 1927.

Illumination

Traffic Control by Color Signals.—K. W. MACKALL.—The author outlines the history of the development of the electric traffic-control signal system, tracing the new developments which have taken place in the industry since its inception, only six years ago. The type of signal best adapted for various classes of service, its installation, the flexibility of control, the optics of the signal, its visibility as affected by location, and the traffic cycle as affected by color sequence, are all discussed, and numerous illustrations are shown portraying various points under consideration.—*Transactions of Illuminating Engineering Society*, May, 1927.

Automatic Luminous Sign Writer.—A. CHURCHOD.—Two automatic electrical devices are described which spell out in luminous letters any word or sentence for advertising purposes. The first type uses an endless chain of metallic block letters, which passes through a special contacting apparatus, illuminating a group of lamps on the signboard that corresponds to the shape of the block letter. As there are several of these letters in the contacting device at the same time, a complete word appears, lighted, on the sign. The second type utilizes an old motion-picture film into which the wording of the advertisement has been perforated. The film is then passed through a contacting device, similar to the one first described, and causes the proper lamps of the sign to light. Both types are motor-driven and can be arranged to spell out a message lasting up to fifteen minutes.—*Revue Générale de l'Electricité*, May 7, 1927.

Motors and Control

Driving and Control of Machine Tools.—W. WILSON.—The majority of machine tools can be grouped under the following heads: (1) Small-power tools possessing a motor of about 1 hp. or less; these would be completely controlled by a plain switch. (2) Those requiring moderate power, such as 5 hp. or 10 hp., without speed control, for an infrequent auxiliary function such as the raising and lowering of the tool-bearing cross-bar of a boring mill or planer; a simple drum switch usually suffices for these. (3) Machines of moderate horsepower, such as many types of lathe, small shaping machines, etc., that need infrequent starting and no reversing or braking, and usually no speed control; automatic control is optional, but to be preferred. (4) Machines of moderate horsepower, such as radial drillers and screwing machines, that require repeated starting and reversing and must be lever-controlled, but do not call for special braking or speed regulation; contactors must be employed for these. (5) Machines of fairly large horsepower, such as boring mills, that require to be started infrequently in one direction only, but must be capable of being inched both forward and back for setting up, and for which speed control and braking may also be required; automatic control is indicated for these. (6) Machines such as wheel lathes requiring ordinary "lathe" control, except that there must be provision for slowing down over given portions of the revolution; requiring automatic control. (7) Reciprocating machine tools of fairly large power, such as planers, slotters, shapers, etc., that require reversal of the motor at the beginning and end of each stroke, with dynamic braking, rapid acceleration, quick return and quick motion when "cutting air," adjustable speed at all parts of the cycle, and inching both ways for setting up. This class demands the most advanced form of contactor or Ward Leonard gear.—*Electrical Engineer of Australia and New Zealand*, April 14, 1927.

Heat Applications and Material Handling

Low-Temperature Electric Ovens.—EDWIN FLEISCHMANN.—Electrically heated ovens designed for temperatures below 700 deg. F. have for years been used with great success for baking bread or japans, carrying on drying processes of many kinds and performing numerous other similar operations. Reduction in fire hazard, fewer rejections of material and less shinkage are among the facts to be taken into account in the use of electricity. The author proceeds to discuss in some detail the construction of electric ovens, their installation and other items of technical interest with respect to their operation.—*Industrial Engineer*, June, 1927.

Electrophysics, Electrochemistry and Batteries

Index of Refraction and Dielectric Constant of Water Vapor.—ARTHUR BRAMLEY.—Using an interferometer method, a study was made of the variation of the index of water vapor with the voltage applied to a cylindrical condenser. The effect observed, which was proportional to the square of the electric intensity, agreed well with the predicted effect but could not be accounted for by the change in density due to the electrostriction effect. The same method was used to measure the change in the refractive index of air at atmospheric pressure and mercury vapor at a pressure corresponding to room temperature, but no effect was observed with fields up to 50,000 volts per centimeter. While, according to the author, it is not possible at present to verify the theory in this prediction by actual observable phenomena, the theory presented does make it possible to account quantitatively for variation of the index of refraction of water vapor with applied electric field for which the electrostriction effect is unable to account, as it considers only the change in density and not the equally important change in the probability of transition which appears in the Lorentz-Kramer dispersion formula.—*Journal of Franklin Institute*, May, 1927.

Telegraphy, Telephony, Radio and Signals

Large Loud Speaker.—F. TRENDELENBURG.—To reproduce telephone messages or music with sufficient volume to fill a large hall with the minimum of acoustical distortion, an electrodynamic loud speaker has been used with success in which an insulating foil 20 in. x 20 in. in size carries a few turns of edgewise-arranged copper ribbon which, in turn, fit between the pole pieces of a great number of small electromagnets. The telephone current passes through the ribbon, while the magnets are excited by direct current. An electrodynamic action takes place between the two, setting the large foil vibrating. Two 400-watt vacuum tubes in opposing connection furnish the power for the speaker. The advantage of this type of loud speaker is that the entire foil surface is acted upon and contributes uniformly to the sound emission, and that it is possible so to strengthen the foil as to avoid any resonance of the foil itself. In co-operation with this speaker a condenser type of microphone was found superior to any other type.—*Siemens Zeitschrift*, March, 1927.

Miscellaneous

Tables of Electricity Supply Costs.—Contained as a supplement in the May 5 issue of the *Electrical Times* (England) are very complete tables of cost and records with detailed notes and references for all electricity supply companies generating or selling electrical energy in England, Wales, Ireland and Scotland.—*Electrical Times*, May 5, 1927.

Voltage Standardization.—A. HUBER-RUF.—A review of the points of view which in general influence standardization of voltages, and a number of proposals of certain standards, are given in this paper. The discussion pertains to classes of voltages, three-phase systems, direct-current systems and nominal voltages. A plea is made for the use of the ratio of $1:\sqrt{3}$ for working voltages. The report emphasizes, intentionally, according to the author, the importance of the three-phase current for the distribution of energy for lighting and power, as the standardization of voltage is influenced thereby. The report deals very fully with the question of star-delta change-over of machine and transformer windings, for the following reasons: In standardizing great importance is attached to voltages used hitherto. In addition to this there is to be considered, however, the not less important question of adapting the standardized voltages to three-phase current.—*World Power*, May, 1927.

News of the Industry

San Francisco Fight Begins

Proceedings Start Before California Commission to Condemn Private Distribution Systems in City

SAN FRANCISCO'S effort to condemn for municipal use the distribution systems in that city of the Pacific Gas & Electric Company and the Great Western Power Company at a price much lower than the two utilities are asking was begun last week before the State Railroad Commission, when the first witness for the city was introduced.

Although John J. Dailey, who is conducting the valuation proceedings in behalf of the city, has not announced the figure the city expects to offer for the property, he indicated that it would be far lower than the figures the power companies have produced, totaling approximately $100,000,000.

Dr. W. F. Durand, professor emeritus of mechanical engineering at Stanford University, occupied the witness stand all day, giving his ideas of how severance damages should be computed in condemnation proceedings. He described severance as the "stormy petrel" of public utility suits. The outstanding statement of his testimony was that the city should not have to pay for losses the power companies would sustain in districts outside of San Francisco if the local property is purchased by the city. "San Francisco may have heretofore carried more than its share of the burden placed on all consumers of electricity. If the outside territory has the ill fortune to be severed from San Francisco, the city should not be made to pay for the severance," he said.

In this way Dr. Durand took issue with the statements made by Dr. Arthur T. Hadley, president emeritus of Yale University, who stated before the Railroad Commission that the severance damages should include the entire territory affected. "The final figure of the value of the power companies has been based on so much assumption that there is doubt as to the accuracy of the ultimate result," Dr. Durand said.

After Dr. Durand concluded his testimony the valuation proceedings were postponed until August.

Los Angeles to Try to Enjoin Gas & Electric

The City Council of Los Angeles on June 28 passed a resolution authorizing the city attorney to initiate injunction proceedings against the Los Angeles Gas & Electric Corporation which would prevent that corporation from serving electricity for power and heating purposes in the city. The Council in its resolution declared that the company has never complied with the law requiring it to obtain a franchise from the city for the distribution of electrical energy for power and heating purposes and that it is operating in Los Angeles under a blanket franchise granted by the constitution of the State of California for the purpose of distributing electricity for illuminating purposes only. The Council declared that because the company has no franchise to deliver energy for power and heating purposes to its consumers its operation in city streets and the construction of pole lines and underground conduits to compete with the municipally owned power and light utility is unlawful. It is significant that this action follows closely upon the June 7 election, in which the people of Los Angeles refused to authorize the makink of a valuation survey of the properties of the Los Angeles Gas & Electric Corporation having as its ultimate object their purchase by the city.

Chicago Now Has 132-Kv. Cable

Six Miles of Underground Transmission at This Voltage Put in Operation by Commonwealth Edison—New York's 12-Mile Feeder Almost Ready

BY THE installation of 6 miles of 132,000-volt underground electrical transmission line in Chicago, the first underground cable of this voltage to be put into regular commercial service, the Commonwealth Edison Company has, that company confidently asserts, brought underground transmission up to the capacity and efficiency of overhead transmission and started a new chapter in the history of electrical development. This cable, which went into operation last week, is of the Pirelli type, developed by the Società Italianà Pirelli of Milan, Italy, and manufactured in this country by the General Electric Company. Hitherto underground transmission in the United States has been limited mainly to 33,000 and 45,000 volts, though there are several successful 66,000-volt cables in operation. Thus the Chicago installation doubles the previous maximum voltage.

The Commonwealth Edison Company, however, is not alone in installing cable of this voltage, for the similar plans announced by the Edison-United Company of New York two years ago are rapidly approaching fruition. This company's 132,000-volt underground cable feeder, purchased at the same time as the Commonwealth Edison Company's cable, is now nearly installed from the Hell Gate generating station to the Dunwoodie distributing station in Westchester County, where, after suitable transformation, the power will become available for distribution throughout that county. The cable used is of the same oil-filled type* as the Commonwealth Edison has employed, manufactured one-half by the Pirelli company of Milan and one-half by the General Electric Company under the Pirelli patents.

The installation of the New York cable, which is about twice the length of the Chicago cable, or 12 miles, was started in May, 1926. It is now virtually completed and will be placed in service by the middle or end of July.

PRESIDENT INSULL'S STATEMENT

"Regular employment of this 132,000-volt cable is a long step forward," said Samuel Insull, president of the Commonwealth Edison Company, speaking of the Chicago installation. "In its relation to superpower development in great industrial areas, and therefore in its influence upon the future of the electrical industry, this step is quite likely to take rank with the introduction of the steam-turbine for generating energy on a large scale. The efficiency and economy of mass production of energy have been made possible by the steam turbine, used in larger and ever larger units. Successful underground transmission at voltages much higher than have been employed will greatly enhance the availability of mass production in populous industrial areas."

The new Chicago cable extends from the Commonwealth Edison Company's Northwest station at 3400 North California Avenue, to a point in Devon Avenue one-half mile west of Crawford Avenue. There it connects with a 132,000-volt overhead transmission line of the Public Service Company of Northern Illinois, which extends north 30 miles to that company's Waukegan power station. The new construction consists of underground conduits containing three lead-sheathed cables, each slightly more than 3 in. in diameter. The hollow core is filled with oil under pressure, the oil impregnating the paper. Elevated oil reservoirs are placed at intervals along the line, keeping the core filled and under pressure. The cable can carry upward of 100,000 kw. It is now carrying in regular service about half that.

*An experimental installation of 6,000 ft. made a few years ago on a 130,000-volt line in Italy was described in the ELECTRICAL WORLD of March 21, 1925. A technical paper on the part of the manufacturers and users of the New York and Chicago 132,000-volt oil-filled cable is under preparation for presentation to the A.I.E.E. in the fall. Some of the possibilities of the oil-filled versus solid-insulation cables are discussed in the 1927 report of the committee on power transmission and distribution presented at the summer convention of the A.I.E.E. in Detroit last week.

Ontario Municipal-Plant Men Want St. Lawrence Power

At the annual convention of the Ontario Municipal Electrical Association and the Association of Municipal Utilities, held at Niagara Falls, Ontario, on June 23, C. A. Maguire, Ontario

Hydro Commissioner, and W. S. Connolly of Morrisburg, Ontario, president of the New York-Ontario Power Company, joined in voicing a demand upon the Dominion government for prompt and favorable consideration of the St. Lawrence development plans. About 500 delegates—engineering, Hydro engineering, administrative and municipal officials—were present and applauded the sentiments voiced by these speakers. "We cannot understand," declared Mr. Maguire, "why the federal governments of both countries, from the navigation development standpoint, should not delegate representatives from each country and see that this development is started in order to benefit the people of both countries."

Mr. Connolly dealt with the subject from a slightly more technical standpoint and declared that there is no other lake and river system anywhere in the world comparable to the Great Lakes and the St. Lawrence in potential power and navigation benefits. "There is nothing about the St. Lawrence development scheme," he said, "that is difficult. It is no exaggeration whatever to say that it is feasible from every standpoint. He calculated that there is about 2,000,000 potential horsepower in the international stretches of the St. Lawrence, which would be divided between New York State and the Province of Ontario. Eastward from Cornwall there is an additional potential 2,500,000 hp., all going to waste. The cost of the development and transmission of St. Lawrence power, he added, would compare favorably with rates now charged between Niagara Falls and Toronto. Mr. Connolly thought it an economically sound doctrine that the related power and navigation projects should bear their respective proportions of the cost. Either project, he said, could be gone ahead with first, independently of its sister project, without hindering the other.

New England Business Men Favor St. Lawrence Plan

A unanimous report favoring the construction of the St. Lawrence ship canal by agreement between the United States and Canadian governments was made public last week by a joint committee representing business and public interests of the six New England States. Construction of the waterway would cost between $350,100,000 and $385,500,000, the report said, depending upon the exact plan adopted, but most of this money, it asserted, would be returned from power development, since the waterfall from Lake Ontario to Montreal is 244 ft. The net cost of the waterway for navigation was estimated at between $123,000,000 and $148,000,000.

Solid 132-Kv. Cable Is Now in Use by New Jersey Company

Last February the Public Service Electric & Gas Company of Newark, N. J., connected to its lines at its Kearny generating station 2,900 ft. of three makes of 132,000-volt underground cable—about 950 ft. of each type—and conducted field tests upon it. On June 1 this cable went under load. It is not oil-filled, but was leaded after impregnation, can be jointed without loss of the compound and is designed to require no reimpregnation after installation. The three manufacturers that supplied the cable for the experiment were the Okonite-Callender Cable Company, the Safety Cable Company and the Standard Underground Cable Company.

North Central Men Meet on Steamboat

Before an Amphibious Convention President Sands Pleads for Good Public Relations—Commercial Activities and Rural Service Are Fruitful Themes

A PERTINENT consideration put before the annual convention of the North Central Division of the National Electric Light Association by the new president of the parent body, H. T. Sands, was that the electrical industry as the trustee of the capital invested in it is under an obligation to the furnishers of that capital which is as broad and which affects as many people, when the original sources of money are considered, as its obligation to supply electricity to the public. Added to the thousands of direct shareholders are countless other individuals who by purchase of insurance and by deposits in savings banks indirectly supply capital to the industry. These persons, whose contributions large and small unite to form billions of dollars in central-station investment, have as large an interest in what does happen or may happen to private ownership of electric utilities as the people who use the energy in their places of business and their homes.

President Sands went on to say that the work which now awaits doing by the Public Relations Section of the N.E.L.A. in preparing an informed public opinion to combat propaganda for governmental ownership and operation of electric utilities was worthy of comparison with the achievements past and future of the three other sections of the association.

The introduction of the uniform classification of accounts, the present-day average generating efficiency of less than two pounds of coal per kilowatt-hour over the whole nation, the development of industrial loads in the past and the growth of domestic and rural loads in the future—these have been and are the work of the Accounting, Engineering and Commercial Sections, the speaker said, and it is the preservation and extension of such accomplishments that now looms up as the immediate concern of the Public Relations Section. Public relations is a work now barely begun and never to be finished.

By Water and Land

Mr. Sands' address was made on the last day of the convention on the steamer *Noronic* at the banquet which capped a series of interesting and informative meetings. The convention left Duluth, Minn., for its meetings afloat and ashore on the evening of June 24 on the steamer *Hamonic* with about 450 in attendance. On that evening the convention was formally opened with an address from the president of the division, Carl J. Snyder, who recited the achievements of the division in the past year, stating that much benefit had been derived from the meetings of the sectional committees in various cities and recommending that this method of sharing information be continued.

After a visit to Port Arthur, Ontario, Saturday morning, in which inspection trips to the large grain elevators and paper and pulp mills were made, the second session was held in the afternoon. At this meeting Miss Isabel Davie, secretary of the national women's committee, explained the workings of the committee and the results it was obtaining. J. W. Devereaux of the Byllesby Engineering & Management Corporation gave a talk on ways and means of effecting a greater use of electrical appliances, explaining what has been done by the Byllesby properties to this end. Proper selection of office locations and layout and design of appliance sales areas were fully explained.

Papers were read also by L. S. Leavitt and P. L. Miles on the sale of electric refrigerators and ranges. A parallel meeting of the women's committee of the North Central Division was conducted by Mrs. Mabel Wilson, chairman. In the evening Edward F. McKay, manager of the Oklahoma Utilities Association, addressed the convention on "Fixing Our Fences." He pointed out that it was the success of private initiative and capital in bringing the power industry to its present magnitude which has drawn the envious eyes of demagogues upon it. He restated the old truth that safety from interference lies only in mediocrity, because non-success invites an interference designed to help or to subsidize, while conspicuous success excites covetousness.

On Sunday morning the convention transferred from the steamer *Hamonic* to the *Noronic* at Sault Ste. Marie. In the afternoon Dr. E. A. White, director of the National Committee on the Relation of Electricity to Agriculture, made a short address on rural service. Although Dr. White made no attempt to sermonize his talk, his treatment of the subject was admirably fitted to the day. Prof. E. A. Stewart of the University of Minnesota described conditions of rural electric service in Europe, illustrating his remarks with excellent lantern slides. In the afternoon Lieutenant Governor W. I. Nolan of Minnesota gave what was called on the program an "electrical sermon." Pleading ignorance of both electricity and sermonizing, the speaker dwelt on the need in the electrical industry, as in all others, for acquaintanceship, friendliness and understanding of the industry by the people it serves.

Federal Board Activities

Permits or Licenses Sought for American, Kanawha, Wabash and Other Streams—New Salary Plan

THE American River Water & Power Company of Auburn, Cal., has applied to the Federal Power Commission for a preliminary permit covering a proposed development on the North and Middle Forks of the American River in Placer County, Cal. The main reservoir, on Middle Fork, will have a capacity of 100,000 acre-feet. The water from the North Fork is to be diverted and stored in that reservoir. The water from the reservoir will be conducted through 10 miles of canal to Power House No. 1. The water will then be carried another 10 miles in canals and tunnels to Power House No. 2. In this way 54,380 hp. of primary power can be made available. The installation will amount to 80,227 hp.

The West Virginia Power Company of Charleston, W. Va., has applied to the commission for a preliminary permit covering a proposed project on the Kanawha River. It is the intention to build two dams to replace the existing government dams Nos. 2, 3, 4 and 5, provided the United States will build navigation dams. It is planned to install 50,000 hp. The application conflicts with that of the New Kanawha Power Company, a subsidiary of the Union Carbide Company. The West Virginia company is a subsidiary of the Appalachian Electric Power Company.

In accordance with the terms of its preliminary permit, the Wabash Hydro-Electric Company of Indianapolis has applied for a license covering its project on the Wabash River in Cass County, Ind. It is planned to build a dam 17 ft. high at Georgetown. This will create a reservoir 5.8 miles long extending upstream to Logansport. It is proposed to install 3,750 kva.

The Royal Development Company of Leavenworth, Wash., has applied for a license covering a 1,000-hp. project on Phelps Creek, in Chelan County, Wash. The power is to be used for mining purposes. The company states that it has complied with the terms of a preliminary permit issued to it Oct. 8, 1926.

The Montana-Idaho Mines Corporation of Winston, Mont., has applied for a license for a 220-hp. project on Beaver Creek in Broadwater County, Mont. The power is to be used for mining purposes.

The Eastern Oregon Development Company of Baker, Ore., has applied for a license for the necessary transmission line to provide interconnection with the Idaho Power Company.

In accordance with a provision in the last independent offices appropriation act, the Federal Power Commission will submit estimates in the near future to the Bureau of the Budget which will include the salaries of the members of its staff, now being paid from the appropriations of the War, Interior and Agricultural Departments. The water-power act provided only for the salary of the executive secretary. The personnel for the conduct of the work was loaned by the three departments. As the assignments have become practically permanent, there has been increasing objection to the method of salary payment.

Michigan Association's Mackinac Island Program

Programs for the combined conventions of the Michigan Electric Light Association and the Michigan Gas Association, to be held at Mackinac Island, July 5 to 7, were released on Thursday. Four hundred and fifty executives and managers, a record number, have made reservations. Alex Dow, president Detroit Edison Company; Prof. Alfred H. White, dean of chemical engineering at the University of Michigan; A. C. Marshall, Detroit, chairman Michigan Committee on Public Utility Information, and Miss May S. Fletemeyer, Hammond, Ind., will address the joint session of the two associations on July 7. C. W. Tippy, Jackson, vice-president and general manager Consumers Power Company, will be toastmaster at the annual banquet on Wednesday evening, and E. C. Hodges, New York, will make the principal address of the evening.

The Electric Light Association's program includes: President's address, D. E. Byerley, Adrian; "Radio Interference," A. B. Buchanan, Detroit; "Training Employees in the Interest of Public Relations," John K. Swanson, Saginaw; "Electric Refrigeration," R. S. Bell, Jackson; "Experiences in Making Contacts with Farmers in the Matter of Farm Electrification," J. H. Flessner, Monroe; "Rural Electrification in Michigan," Prof. H. J. Gallagher, department of agricultural engineering, Michigan State College, and discussion of rural electrification progress by Eugene Holcomb, Jackson.

Suit Over Laclede Gas in Missouri Arouses Interest

The recent sale in St. Louis at a very high price of the majority stock holdings of Charles A. Munroe and others in the Laclede Gas Light Company and the Laclede Power & Light Company (now controlling the company's electric department) to the Utilities Power & Light Company, of which Harley L. Clarke of Chicago is president, has started a dispute which is attracting much attention in public utility circles. The validity of the perpetual franchise claimed by the Laclede company is attacked and the Attorney-General of Missouri, on the application of the Mayor of St. Louis, has under advisement the question of bringing court proceedings to clarify the company's status. A suit has also been filed for a receivership, but is said not to be taken seriously by the Utilities Power & Light officials.

An active part in the contest has been taken by the Union Electric Light & Power Company of St. Louis, which supplies the great bulk of the power used in that city. This company, with the North American Company of New York, its owner, has vigorously condemned the sale of the Laclede company at the price realized, on the ground that the payment of excessive prices for utility properties, upon which no adequate return can be realized, is an injury to the whole utility business of such a character that it becomes the concern of others besides the participants in the transaction.

A fuller statement of the financial and legal aspects of the case will be printed under "Financial and Statistical" in an early issue of the ELECTRICAL WORLD.

Full Program for East Central N.E.L.A. Meeting

The third annual convention of the East Central Division, N.E.L.A., to be held at the Breakers Hotel, Cedar Point, Sandusky, Ohio, July 12-15, will open on Tuesday morning with an address by President J. P. Pope, followed by Secretary D. L. Gaskill's review and by a report on rural electrification by J. P. Johnson and an account of experimental work by Prof. J. W. McCuen. Other reports and addresses will fill six additional sessions—technical, public relations, commercial and accounting—Chairman George E. Snider, W. R. Power, H. W. Derry and J. J. McKenna respectively giving accounts of the four sections' accomplishments and committee chairmen reporting progress in many directions.

George A. Davis will speak on "Our Public Relations and Their Importance." J. E. Davidson, Frank E. Watts and Earl Whitehorne will make addresses on commercial topics, and there will be discussions on Thursday morning, under the auspices of the power committee, on commercial heating, baking and cooking applications. President H. T. Sands and Managing Director Paul S. Clapp will represent the parent body, and T. O. Kennedy and Helen E. Steiner of Cleveland will also be heard. An exceptionally fine entertainment program is promised.

New England and Interstate Power Engineers Meet

About thirty members of the New England Association of Central Station Power Engineers and the Interstate Power Club held a pioneer joint meeting June 24 and 25 at Hartford, Conn., for the discussion of mutual problems, the inspection of industrial power and heating installations and the promotion of future gatherings for the sharing of common interests and problems. The delegates were the guests of the Hartford Electric Light Company on June 24 at luncheon, which was followed by an illustrated talk on the mercury-vapor process by L. A. Sheldon of the General Electric Company and visits to the Dutch Point and South Meadow stations at Hartford under the guidance of E. D. P. Gross of the Hartford company, who also arranged for industrial-plant inspection trips. A. S. Moore headed the New England delegation and Frank S. Root a New York and New Jersey group. At an evening session Friday a paper on "Manufacturing Ice Electrically" was presented by E. L. Fleming of the Public Service Electric & Gas Company, Newark, N. J.

Attendance at Salt Lake Breaks Record

Closing Days Equally Successful with Preceding Ones—Engineering, Accounting and Public Relations Sessions Score—Onken Opposes Federal Encroachment

WHEN the Salt Lake City convention of the Northwest Electric Light and Power Association closed on Friday, June 24, the registration of 400 recorded in last week's news columns had reached a total of 444, or nearly 100 in excess of any previous registration. Thursday and Friday were given over to general sessions under the auspices of the Engineering, Accounting and Public Relations Sections, which were equally successful with the Commercial Section meetings already reported.

Less rigidness in cable specifications and fewer demands by power company engineers for special tests were asked by Dr. Robert J. Wiseman, chief engineer of the Okonite-Callender Cable Company, in order that cable manufacturers may devote more of their time to research and the improvement of their product. Increasing cost of hydro-electric power and decreasing cost of steam power due to higher efficiencies are bringing about a change in power production in southern California, according to H. A. Barre, executive engineer of the Southern California Edison Company. He predicted that developments in low-temperature, high-pressure carbonization of coal with recovery of by-products will decrease power-production costs in the future where suitable coals are available.

Advantages of interconnection of power systems were pointed out by Paul S. Clapp, managing director N.E.L.A., who said that arguments for regulation of interconnected power systems by the Interstate Commerce Commission, or a similar federal body, made on the ground that there is a parallel between the railroads and interconnected power systems, is unsound because less than 5 per cent of all electrical energy generated passes across state lines, whereas 70 to 80 per cent of goods moved by the railroads is interstate.

Carl S. Dakan of the University of Washington discussed depreciation and urged electric utilities to agree on a method of accounting for depreciation which will make their reports more understandable to the public. He held this to be particularly desirable in view of the fact that utility securities are now widely held by the general public. He said that it does not make so much difference on what basis utilities agree so long as they adopt a method which can be defended. Historic reproduction cost was advocated by him as the proper rate base.

The concluding session was devoted largely to public relations, with addresses on co-operation with educational institutions and work of the women's committee of the association. Miss Marguerite Butler, general chairman of the women's committee of the Northwest Electric Light and Power Association, said that there are now twelve active committees in the Northwest States that are doing constructive work among the women of the industry.

"Shall We Put the Government Into the Power Business?" was the subject of an address made by W. H. Onken, Jr., editor of the ELECTRICAL WORLD. "Years of experience," Mr. Onken declared, "have not revealed any inherent qualities possessed by the government which would make it more efficient than private enterprise in the conduct of the electric utility business, or even equally efficient. That the policy enunciated by the federal water-power act is rational and enlightened is proved by the millions of horsepower that have been developed under its provisions. It is one of the most outstanding pieces of legislation enacted by any congress, and every effort should be made to safeguard it." In discussing the Colorado River situation the speaker said that the electrical industry is just as anxious to see flood control on the Colorado to protect lives and property in the Imperial Valley as are the politicians, but that flood control should not be made a subterfuge under which the government would enter into the power business, as proposed by the Swing-Johnson bill.

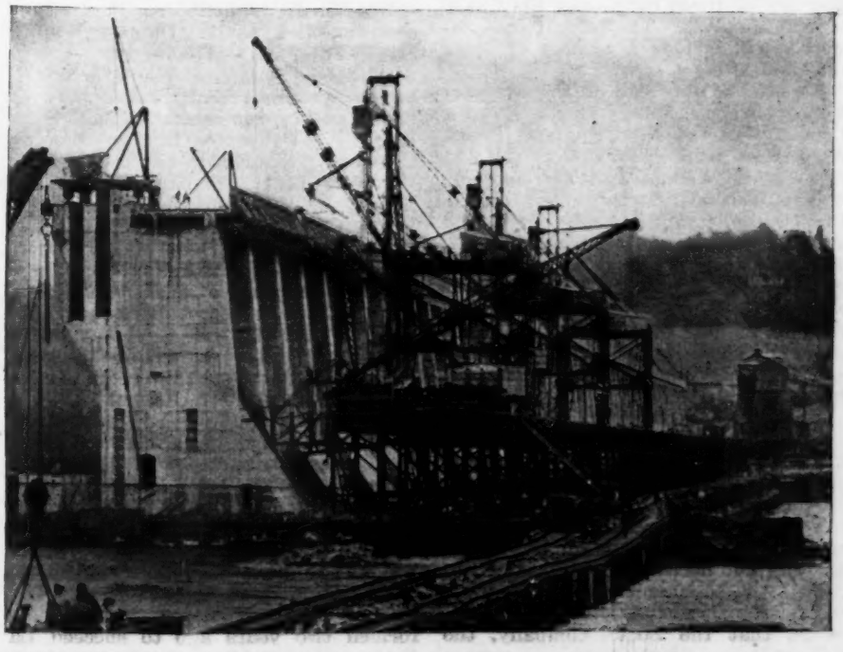
Officers of the Northwest Electric Light and Power Association elected for the ensuing year were: President, A. C. McMicken, Portland Electric Power Company; first vice-president, R. M. Boykin, Puget Sound Power & Light Company.

Lighting Equipment Industry "Its Own Worst Enemy"

Six groups held meetings at the Atlantic City convention of the Artistic Lighting Equipment Association last week. These were the board of directors of the association, the stamping and parts manufacturers, the exterior lighting and lantern manufacturers, the distributor (dealers') section, the Illuminating Glassware Guild and the Associated Lighting Equipment Salesmen. The general session on Thursday was addressed by President Fred R. Farmer and Vice-president J. William Schulze. On Friday T. Yeoman Williams of New York, secretary of the League of Industrial Rights, defended anti-trust laws, which, he said, are not aimed at business associations but at abuse of power.

Managing Director Granville P. Rogers of New York, praising highly the accomplishments of the association in the last year, called the lighting equipment industry its own worst enemy. "There is no lack of program, but lack of organized effort," he said. "Methods of figuring costs and prices are deplorably chaotic. In daily practice the ordinary ethics of business are violated. Our association membership does not represent 10 per cent of our potential membership. Without organization, both in numbers and dollars, no worth-while constructive program will be successful."

Conowingo Dam as It Appears Today



ABOVE is a view of the Conowingo Dam on the Susquehanna River as it appeared to the party of prominent public men, bankers, utility officers and engineers who paid it a visit of inspection on June 17, as related in last week's ELECTRICAL WORLD (page 1396). Progress on this great development is being made at a rate that promises to fulfill the prophecy made by Alexander Wilson, construction engineer of the Philadelphia Electric Company, on Oct. 7, 1926, when he said that by December, 1928, Philadelphia would be drawing power from the Susquehanna River.

Purchases and Mergers

Fifteen North American Properties Are Consolidated—Wisconsin and Massachusetts Transactions

CONSOLIDATION of fifteen Wisconsin and northern Michigan public utilities, all subsidiaries of the North American Company, in the Wisconsin-Michigan Power Company is announced by S. B. Way, president of that company. The consolidated property represents a valuation of $16,000,000. The Wisconsin Traction, Light & Power Company, Appleton, will join in the consolidation, in which the former Peninsular Power Company, recently named the Wisconsin-Michigan Power Company, and thirteen smaller companies will be merged. Other Wisconsin companies included are the Wisconsin Northern Light, Heat & Power Company, Weyauwega Electric Light Company, Badger Utility Company and Star Electric Company, all doing business north and west of Appleton; Aurora Electric Light & Power Company and Niagara Light & Power Company of Florence and Marinette Counties. Michigan concerns are the Iron Mountain Electric Light & Power Company, Alpha Lighting Company, Amasa Lighting Company, Loretto Light & Power Company, Dickinson County Public Service Company, Powers-Spalding Light Company and Twin Falls Light Company. The Michigan companies operate in Iron, Dickinson and Menominee Counties.

Negotiations are understood to be virtually completed for the acquisition by the Byllesby interests of the Wisconsin Valley Electric Company and its subsidiaries, including the Wisconsin Valley Power Company. Headquarters of these companies have been at Wausau, Wis. The sale, if consummated, will include a number of dams and dam sites.

Reports of the sale of the Webster & Southbridge (Mass.) Gas & Electric Company to the New England Power Association were confirmed at the former's offices Wednesday. The company serves Webster, Southbridge, Oxford, Dudley, Charlton, Sturbridge, Brimfield and Wales and was organized in 1887. The sale price is stated to be approximately $3,280,000 and 8,000 shares were involved. The company has paid regular annual dividends of $10 per share for some time. Within the past month the stock has risen in quotations from $195 bid to $410.

Mills Brothers, owners and operators of the Sodus (N. Y.) Gas & Electric Light Company, have acquired control of the Northern Cayuga Light & Power Corporation through the purchase of its entire outstanding common stock. It serves a territory east of the Sodus territory and northwest of Syracuse, including the communities of Cato, Fairhaven, Sterling and Victory. It is reported that the Sodus company, the Marion Power Corporation and certain water-power properties of the Preston Power Corporation will be merged as the Lake Ontario Power Corporation. This would bring a complete transmission and distributing system supplying sixteen or more communities extending with one small break from Rochester to within a few miles of Syracuse. The system is connected directly with the Rochester Gas & Electric Light Company at its western end and with the Mohawk-Hudson Power Corporation system at its eastern end.

The New York Public Service Commission has granted Emory Souve permission to transfer his distribution system in the town of Vienna, Oneida County, to the Niagara, Lockport & Ontario Power Company. The transfer does not include his generating plant and distribution system at Sylvan Beach.

The Vermont Public Service Commission will hold a hearing July 6 on the petition of the Bellows Falls Canal Company and the Fall Mountain Electric Light & Power Company, which seek to merge under the former name. Both are in the electricity supply business.

The Missouri Public Service Commission has been asked to approve the merger of four public utilities in various parts of the state into the Missouri Electric Power Company, which maintains its headquarters in St. Louis. The four companies have combined assets of more than $2,000,000 and are now controlled separately by the Central States Light & Power Corporation of Davenport, Iowa. The merged company will retain the name of the Missouri Electric Power Company. The other companies involved are the Missouri Power & Development Company, operating in Willow Springs and Cabool; the Southeast Missouri Public Service Company of Doniphan, and the Telephone Service Corporation, also of Doniphan.

Six more Arkansas towns have quite recently sold their electric plants to the Arkansas Power & Light Company and will go on its high-tension lines. They are McGehee, Gould, Dumas, Walnut Lake, Tillar and Winchester.

Oklahoma municipal plants or distribution systems recently taken over by public utility companies include Fairland by the Empire District Electric Company, Stratford by the United Power & Light Company, Bessie and Leedey by the Southwestern Light & Power Company, and Grove (subject to the voters' approval) by C. T. Brotherton of Springfield, Mo.

The Nacogdoches (Tex.) municipal power plant has been transferred to the Texas Power & Light Company under terms arranged a year ago and recently ratified by the voters.

L. L. Stephenson, owner of the Yoakum (Tex.) Light & Water Company, has sold it to the Texas-Louisiana Power Company for $640,000.

The Gatineau Power Company, subsidiary of the International Paper Company, has made an offer to purchase the Quebec Southern Power Corporation, which has been accepted, subject to confirmation by the shareholders. The Quebec Southern Power Corporation, formed two years ago to succeed La Compagnie Electrique des Laurentides, which operated a small plant at Rawdon serving nine towns and about 1,000 customers, linked that concern with the Laurentian Hydro-Electric Limited, acquired the municipal hydro plant at St. Jerome and a fourth plant at L'Annonciation, and today supplies between 45 and 50 communities and 5,000 customers. It has a potential generating capacity of about 90,000 hp., all within 50 miles of Montreal.

Notes from the Dominion

Ontario Hydro Awards Contract for Line from Ottawa to Toronto—Eastern Ontario Power Situation

THE Ontario Hydro-Electric Power Commission has awarded the contract for construction of the 220,000-volt, single-circuit line from the Ottawa River to Toronto—about 200 miles in length—to its own construction department. To a number of tenders the most careful consideration was given by the commission, but that of its own department was the lowest. This line will carry the Gatineau power westward. It will be taken straight through to Toronto. According to Premier Ferguson, none of the power will go to eastern Ontario immediately.

The third unit of 34,000 hp. at the Chelsea power house of the Gatineau Power Company, on the Gatineau River, in the Province of Quebec, has been completed, making possible a total output of 102,000 hp. from this plant at present. Two further units have still to be completed before the complement is reached.

As another step toward "cleaning up" the eastern Ontario power situation, Premier Ferguson has directed the Hydro-Electric Power Commission of Ontario to commence negotiations for a settlement with those people whose private power rights at Chats Falls, on the Ottawa River, were taken over by the Ontario government under the expropriation plan filed by the late Sir Adam Beck in 1911. If negotiations prove unsuccessful, the government is prepared to arbitrate the question. Sir Adam's expropriation plan was filed, Premier Ferguson explained, because, in the former's opinion, the power owners involved were asking an exorbitant price for their water rights. Several million dollars is involved in the negotiations. William Harty of Kingston, Ontario, and the estate of the late Daniel O'Connor of Ottawa are pressing for adjustment.

Governor Young Appoints Colorado River Commission

Governor C. C. Young of California on June 24 appointed John L. Bacon, former Mayor of San Diego and president of the Boulder Canyon Dam Association; W. B. Mathews, special counsel of the Los Angeles Board of Water and Power Commissioners, and Earl C. Pound, president of the board of directors of the Imperial Irrigation District in Imperial Valley, as members of the California Colorado River Commission. The act which authorizes the naming of this commission does not become effective until July 29, but Governor Young explained his action on the ground of the need for time to organize. Under the legislative act creating the body, it will be the duty of its members to confer with official representatives of the other Colorado River Basin states involved in the proposed Boulder Dam legislation with a view to uniting all factions.

New Colorado River Conference May Be Called

As the result of a secret conference between members of the Arizona Commission on Colorado River Development and officials of the State of Colorado, which was held at Denver recently, and of further conferences which the Arizona men have held with officials of the other upper basin states, it is predicted in Denver that a new seven-state conference will be called soon by one of the governors at which the entire Colorado River problem will be thrashed out and a new compact possibly drawn.

United States Senator Charles W. Waterman and Congressman Edward T. Taylor of Colorado warned the conferees against the danger of power priorities if settlement of the river problems is not made by the states before 1929. If no compact between the states is in operation by that year, they said, the Federal Power Commission is likely to grant power permits on the Colorado River, threatening injury to irrigation projects. Mr. Taylor suggested that Colorado, Wyoming and Utah institute a suit to get the question before the United States Supreme Court in the hope of thereby protecting state rights and priorities.

At Salt Lake City the Arizona and Utah men decided to leave the matter of calling a new conference of the seven states to Governor Dern, who will decide when and where the meeting shall be held, after consulting with the Governors of Wyoming and Colorado. Opinion seemed to favor holding this conference before the conference of the governors of all states on July 25.

A.I.E.E. to Hold 1928 Summer Meeting in Denver

At a meeting in Detroit on June 23 the board of directors of the American Institute of Electrical Engineers approved a proposal to hold next year's summer convention in Denver in the week beginning Monday, June 25.

Plans for the Engineering Summer Schools

The Engineering Foundation announced recently final plans for the summer schools for engineering teachers to be held at Cornell and Wisconsin Universities beginning July 6. Both schools will be conducted under the joint auspices of the Foundation and the Society for the Promotion of Engineering Education.

"These two universities have been selected to undertake an experiment in training college teachers in engineering methods of teaching the basic subjects of the engineering curriculum," says the announcement of the Engineering Foundation. "This summer the subject of mechanics has been chosen on account of its fundamental importance."

Dean Dexter S. Kimball of the Cornell College of Engineering will be director of the summer school for engineering teachers at Cornell, and Prof. E. R. Maurer, head of the department of mechanics at Wisconsin, will head the summer session at that institution. Dean Kimball is president of the American Engineering Council and an authority on machine design and industrial management. Professor Maurer is an authority on strength of materials and the principles of reinforced-concrete construction.

Electrifying Agriculture

Public Utility Men Discuss with Farm Engineers at St. Paul How Best to Promote It

AS REPORTED last week, the convention of the American Society of Agricultural Engineers opened on Wednesday, June 22, at the Agricultural College of the University of Minnesota. The first two days were given over largely to the question of rural electrical service, and these sessions were presided over by Arthur Huntington, of the Iowa Railway & Light Corporation, Cedar Rapids, a prominent advocate of farm extensions. In a paper by Prof. J. B. Davidson of the University of Iowa the statement was made that agriculture to bring itself into the economic position of other industries must accept new standards and new methods. The reports of committees on farm wiring and farm lighting were presented by B. P. Hess and W. C. Brown respectively. The data presented from 87 farmsteads in the experimental projects showed an average of 800 watts connected, a figure which, it was held, would be doubled or tripled if good lighting practice were followed.

Miss Eloise Davidson reported on the results of the short course at Ames, Iowa, last spring and said that cooking could be taken as from 25 per cent to 85 per cent of the total farm load. W. C. Krueger brought out the wide variations not only in the kinds of feed grinding but in electrical consumption for the same kind with different machines and under different conditions of operation. E. A. Stewart gave a profusely illustrated description of European rural electrification. A paper on farm refrigeration by W. T. Ackerman described a milk-cooling room and its construction. Rural electric rates were dealt with in a paper by N. T. Wilcox. G. C. Neff spoke on rural electrification from the utility manager's point of view, and Charles H. Churchill, Jr., explained the development of methods and equipment for extending the use of electricity in agriculture.

A paper by R. F. Pack, retiring president of the N.E.L.A., was read by Dr. E. A. White. Mr. Pack said that the formation of the committee on rural electric service in the association was the result of the conviction that it was the duty of the power companies to do the job if in any way it could be done. From the meager information available at first there has grown a voluminous record of experience, but it is not yet comprehensive enough to justify the statement that the problem is solved. The utility companies make every effort to impress upon the farmer that large energy consumption is the only way in which rural electricity supply can be made as profitable as it must be made to both the farmer and the supplying company.

Electric Utility Advertising, Ten Million in 1927

Twenty-eight million dollars was named as the sum the public utility companies are going to spend on advertising during 1927 by Frank LeRoy Blanchard, president of the Public Utilities Advertising Association, in opening the fifth annual meeting of that organization at Denver on Monday, June 27. Nearly 300 delegates were on hand for the meeting, which was held in connection with the annual convention of the International Advertising Association.

Describing the development of advertising in the utility field, Mr. Blanchard said: "When the Public Utilities Advertising Association was organized many of the companies represented were either advertising spasmodically or not at all. Advertising was regarded as an unnecessary expense—a waste of money. I fear that there are still some companies that maintain this attitude, but their number is rapidly diminishing. In 1922, when our organization was founded, the amount invested in advertising by the public utilities was about $14,000,000; in 1925 it had increased to $22,000,000, and in 1926 to $25,000,000. According to the best estimate available the amount this year will be $28,000,000, of which the electric light and power companies alone will invest $10,000,000."

Eight reasons for the adoption by the Westinghouse Electric & Manufacturing Company of its all-newspaper advertising program, now running in more than 300 newspapers throughout the country, were outlined by J. C. McQuiston, advertising manager of the company, before the Association of Newspaper Advertising Executives at the convention. These were, Mr. McQuiston said, to promote intimacy, flexibility, "dealer tie-in," "reader interest" and immediate sales, to promulgate co-operative good-will messages, to support sales and to check results.

American radio interests plan to take the initiative next fall in proposing the establishment of a transatlantic radio program exchange service through which owners of radio sets in either America or Europe may be able to tune in on transmitters in the other continent, it was announced by M. H. Aylesworth, president of the National Broadcasting Company.

Michigan Public Utilities Board Reorganized

A reorganized Public Utilities Commission, composed of two old and three new members, has taken office in Michigan. The old members are Samuel Odell of Shelby, who has been a member since the commission was organized in 1919, and Sidney E. Doyle of Detroit, who succeeded Attorney-General W. W. Potter last January. The new members are Byron P. Hicks of Owosso and Robert H. Dunn of Muskegon, both lawyers, besides James Bice, who for 28 years has been chief inspecting engineer for the commission and its predecessor. Chairman Sherman T. Handy, Ralph Duff and Samuel Pepper were not reappointed. All of the members will serve until June 13, 1931.

Attack Merger Desired by New Jersey Public Service

Merger with the Public Service Electric & Gas Company of five of the nine smaller companies which the New Jersey corporation desires to absorb is being attacked in the state courts, an injunction to prevent the transaction being sought by a committee of stockholders of the five companies as "unfair and unjust." Argument on the motion was continued until July 12.

The five companies named in the petition are the Essex & Hudson Gas Company, Hudson County Gas Company, Paterson & Passaic Gas & Electric Company, New Brunswick Light, Heat & Power Company and the Somerset, Union & Middlesex Lighting Company. In these the Public Service Corporation is understood to have acquired two-thirds stock ownership. The other companies in the proposed merger are the South Jersey Gas, Electric & Traction Company, Gas & Electric Company of Bergen County, Newark Consolidated Gas Company and the Ridgewood Gas Company. Merger of the first group had been scheduled for last week.

French Lick Meeting of Society for Testing Materials

The thirtieth annual meeting of the American Society for Testing Materials was held at French Lick, Ind., on June 20-24 inclusive, when the copious committee reports which are usual with this society were presented. These included reports on copper wire, nonferrous metals and alloys, slate, electrical insulating materials and metallic materials for electrical heating. Dr. George L. Clark delivered the Edgar Marburg lecture, taking for his subject "X-Rays in Industry." The twenty-fifth anniversary dinner was a notable feature of the gathering. The Charles B. Dudley medal was presented to Dr. D. J. McAdam, Jr., for a paper on "Stress-Strain-Cycle Relationship and Corrosion Fatigue of Metals." H. F. Moore, professor of engineering materials, University of Illinois, was elected president, and T. D. Lynch, manager materials and process engineering department, Westinghouse Electric & Manufacturing Company, vice-president.

Water-Power Economics at Maine Labor Convention

How the failure of the state to repeal the Fernald law forbidding the exportation of water power is hampering the business development of Maine was set forth at a recent convention of the Maine Federation of Labor at Lewiston by Walter S. Wyman, president of the Central Maine Power Company. Mr. Wyman declared that in the vicinity of a hundred million dollars will be expended on hydro-electric development in Maine within the next few years if the exportation of surplus power is permitted and that the tax revenue of the state will be increased by a million dollars. He pointed out that in several cases important chemical industries have been kept out of Maine by the Fernald act, that the proposed hydro-electric development at Bingham has had to be given up for the time being, and that graduates of the engineering courses in the state capable of undertaking hydro-electric work are obliged to seek employment elsewhere.

In this connection a reported interview at Augusta, Me., with Martin J. Insull is of interest. Mr. Insull, it is asserted, is hopeful that, with the aid of the New England Council, a tri-state agreement between Maine, New Hampshire and Massachusetts will be arranged which will allow electrical energy to flow freely between these three states. He added that the Central Maine Power Company would not test the constitutionality of the Fernald law until there had been ample time to bring about the proposed agreement.

Briefer News

Rochester Gas & Electric Raises Voltage on Niagara Line.—The voltage on the steel-tower transmission line connecting the system of the Rochester Gas & Electric Company with the Niagara territory is being raised from 60,000 to 100,000.

Arkansas Power & Light Company's Expansion.—The recent purchase for $400,000 by the Arkansas Power & Light Company of the light and water plant at Batesville, Ark., will be followed by the extension of its 110-kv. system to Batesville and to industrial settlements in the vicinity of that place, the construction of a transformer substation and other improvements, at a total cost of $750,000.

Suit in Obstruction to Conowingo Project Dismissed.—The suit brought by James C. Colgate, a stockbroker of New York City, to prevent the granting of the right of eminent domain to the Philadelphia Electric Company to take land belonging to him at Conowingo, Md., was dismissed last week by the United States District Court. Colgate has the right of appeal to the United States Supreme Court.

New Hydro Station at Hooksett Dam, N. H.—Another link in the development being carried on by the Public Service Company of New Hampshire in the southern part of that state has been established with the opening of a new power station at the Hooksett dam. The unit now is available for the distribution of energy into any part of the system extending from Keene to Dover. It has a capacity of 2,200 hp., five times that of the plant it displaces.

Illinois House Kills Bill to Regulate Municipal Lighting Plants.—The Illinois House of Representatives has killed by 89 to 29 the Wright-DeKalb bill, which would have placed municipal lighting plants under jurisdiction of the Illinois Commerce Commission. The bill had been passed by the Senate. One member called it "a brazen attempt by utility interests to step in and steal municipally owned plants."

Porto Rico Passes Act to Regulate Engineering Profession.—An act to regulate the practice of engineering, architecture and surveying has been passed by the Porto Rican Legislature and approved by the Governor. It provides for a licensing board, which will approve applications only from technical graduates or from practitioners of three years' standing prior to the adoption of the act.

New York Power Commission Against Licensing Projects in State Parks.—An application by the Commonwealth Power Company for a license for the private development of water power on the Genesee River, which would create a reservoir 17 miles long and fill a small portion of Letchworth Park, has been frowned on by the New York State Water Power Commission, which last week adopted as its permanent policy one of granting no power involving park lands without the request of the State Park Council.

Capital Planning Commission Opposes Potomac Hydro Project.—A formal resolution opposing the development of power at Great Falls on the Potomac River was adopted June 20 by the National Capital Park and Planning Commission. Members of the commission, after a day spent in traversing the site of the reservoir above Chain Bridge, came to the conclusion that Great Falls and the gorge below the falls should be preserved for park purposes. It was held that the development of power would destroy the chief scenic values of the area. In this connection the point is made that neither this commission nor any other agency has concerned itself with the beauty of this area heretofore. For a small amount of money, it is pointed out, the area could have been cleared of stagnant water and unsightly underbrush.

Coming Meetings of Electrical and Allied Societies

[A complete directory of electrical associations, with their secretaries, is published in the first issue of each volume. For latest list see this issue of ELECTRICAL WORLD, page 50.]

Michigan Electric Light Association—Grand Hotel, Mackinac Island, July 5-7. Herbert Silvester, Edison Bldg., Ann Arbor, Mich.

East Central Division, N.E.L.A.—Cedar Point, Ohio,, July 12-15. D. L. Gaskill, Greenville, Ohio.

Association of Electragists International—Hotel Chase, St. Louis, Aug. 8-12. L. W. Davis, 15 W. 37th St., New York.

International Association of Municipal Electricians—Salt Lake City, Aug. 16-19. E. H. Benz, West New York, N. J.

Camp Co-operation VII—Association Island, Henderson Harbor, N. Y., Aug. 28-31. Society for Electrical Development, 420 Lexington Ave., New York.

New England Division, N.E.L.A.—New London, Conn., Sept. 12-15. Miss O. A. Bursiel, 20 Providence St., Boston.

American Institute of Electrical Engineers—Pacific Coast convention, Del Monte, Cal., Sept. 13-16. F. L. Hutchinson, 36 West 39th St., New York.

American Electric Railway Association—Cleveland, Oct. 3-7. J. W. Welsh, 292 Madison Ave., New York.

Attention also is called to the fact that no such obstacle was placed in the way of Senator Norris' proposal to have the project built and operated by the government.

Government's Wyoming Plant to Serve Oil Field.—The Mountain States Power Company of Tacoma, Wash., which serves a number of towns in Wyoming as well as in other states, will, it is announced, build an 85-mile transmission line from the United States government's new hydro-electric plant at Guernsey, Wyo., to Parkerton, Wyo., in the Big Muddy oil field, where connection will be made with an existing line of the Mountain States Power. About $250,000 will be spent for the extension, which it is hoped to have in operation by Nov. 1.

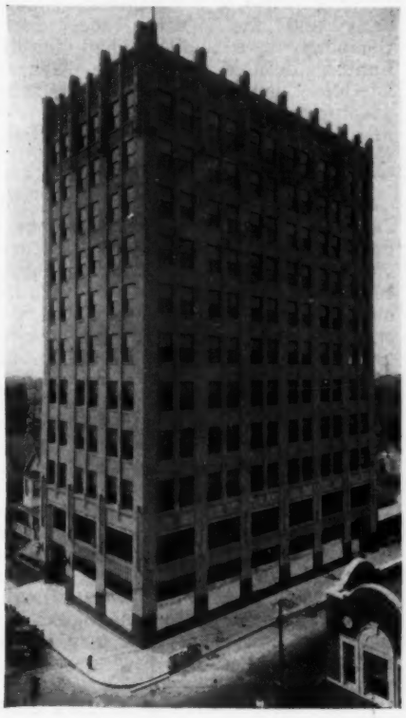
New York Contractors Convene and Elect Officers.—All executive officers were re-elected and L. William Kissewetter of Syracuse was chosen a member of the executive committee for 1927-1928 of the New York State Association of Electrical Contractors and Dealers, which held its twenty-eighth annual convention at Syracuse recently. The officers are: President, A. Lincoln Bush, New York; vice-president, L. R. Rogers, Schenectady; treasurer, James F. Burns, Schenectady; secretary, Herbert F. Janick, Rochester.

Promoting Rural Service in Georgia.—In anticipation of the carrying of hydro-electric power into rural districts, the Georgia Public Service Commission has called upon the various hydro-electric power companies in the state to file rates and regulations with the commission on or before July 15 next, setting out their proposed methods of bringing this about. The Georgia Power Company of Atlanta and its subsidiaries are active in the movement. A demonstration unit was recently installed at the Georgia State College of Agriculture in Athens, where farmers could see it for themselves.

Virginia Electric & Power Company to Furnish Energy to Ahoskie, N. C.—The lines of the Virginia Electric & Power Company have been built to the corporate limits of Aulander, N. C., and a construction gang is now carrying them over the 9-mile stretch to Ahoskie, N. C. J. T. Chase, manager of the Carolina division, states that the work will probably be finished by Aug. 1. As soon as the substation is erected the company will take over the town's distribution system and begin furnishing light and power to Ahoskie. Other towns that will share in the distribution from the line will be Powellsville, Harrellsville and Colerain.

Southern California Edison Orders Synchronous Condensers of Great Size.—Three synchronous condensers of very unusual size, to be used to regulate the voltage of the transmission lines which carry power from the Big Creek hydro-electric development into Los Angeles, have been ordered by the Southern California Edison Company from the General Electric Company. The condensers are each rated at 50,000 kva. and will operate at 13,200 volts. Two are to be installed in the new Lighthipe substation and one in the Eagle Rock substation. Condensers, with a capacity of 30,000 kva., the largest made previously by the General Electric Company, are now being used in the Laguna Bell and Eagle Rock substations of the Southern California Edison Company. The weight of each new condenser with its exciter is 375,000 lb., and the over-all dimensions are: Length, 26½ ft.; width, 16 ft.; height above the bottom of the base, 12 ft.

Asbury Park, N. J., Has Eleven-Story Electric Building.—The office building of the Eastern New Jersey Power Company, recently completed at Asbury Park, N. J., ranks in size and appointments with those in far larger cities than this seaside resort of only 15,000 permanent residents. The building is eleven stories in height, of reinforced concrete with a facing of Indiana limestone on the street elevations. The finish of the main and mezzanine floors is marble and bronze, and the three floors devoted to the business of the company are laid out in thoroughly modern fashion. The building, which is in the center of the business district, is made conspicuous at night by a scheme of colored lighting illuminating its top stories. The Eastern New Jersey Power Company, which serves a considerable stretch of both shore and inland territory in New Jersey, is owned by the Utilities Power & Light Corporation of Chicago.



Muscle Shoals City Asks for Muscle Shoals Power.—A petition from Mayor Arthur Sharpston of Muscle Shoals City has been forwarded to Major-General Edgar Jadwin, chief of army engineers at Washington, urging that the municipality of Muscle Shoals City, now dependent upon gasoline engines for electrical power, be allowed to make connection with the high-voltage line owned by the government and which runs through its boundary lines. Under the plan the power would be bought directly from the government at a rate on a par with that now being charged the Alabama Power Company.

Texas Company Builds 100 Miles of Line in 60 Days.—More than 600 men were employed by the West Texas Utilities Company in running its transmission lines to the Pecos oil fields in Texas, of which McCamey is the center, and these lines were built at what is probably a record-breaking speed, 100 miles being constructed in 60 days. The company, whose rapid growth has already been reported in these columns, now has 15,000 hp. available at McCamey. It is building 50 miles of transmission lines to other sections, carrying power from Abilene and San Angelo. Seventy cities and towns in all are served by the West Texas Utilities over a thousand miles of line.

Barstow Addresses Metropolitan New York Section of N.E.L.A.—W. S. Barstow, president General Gas & Electric Corporation, introduced by John W. Lieb, vice-president New York Edison Company, spoke before a one-day convention of the Metropolitan New York Section of the N.E.L.A. on June 24, taking as his topic "Financing a Public Utility." Others who spoke were H. M. Edwards, vice-president New York Edison Company, on "Accounting Developments," and Earl Whitehorne, commercial editor ELECTRICAL WORLD, on "A Message from the Sales Managers." H. C. Dean was elected chairman and J. J. Ryan vice-chairman for the ensuing term, G. S. Poucher secretary and E. H. Carr treasurer.

To Extend Distribution System of Milwaukee Electric Railway & Light.—Three million dollars is to be spent this year on extending the power distribution system of the Milwaukee Electric Railway & Light Company, according to George G. Post, electrical engineer with that company. Most of the improvements will be made in the Milwaukee area, but they will also extend from the Illinois State line to Campbellsport on the north and as far as Watertown on the west. A new transmission line from Kenosha to the Illinois state line will cost $370,800 and will connect with a similar one from Waukegan, permitting emergency interchange of power between the Milwaukee company and the Public Service Company of Northern Illinois.

Los Angeles Power Department Made Financial Entity. — An ordinance adopted June 15 by the Los Angeles City Council makes the Water and Power Department of that city a financial entity, independent of the city government, with power to go into the market and borrow money and to issue notes or other certificates of indebtedness. To contract these loans the commissioners must determine that an emergency exists, the loans must be for not longer than five years, and the total loans shall not exceed one-third of the total gross operating revenue of the department during the preceding

fiscal year. Under this ordinance the Water and Power Department has rights that no other city department has, as all other departments must ask for funds to be provided through bond issues approved by the voters, and these funds, together with budget appropriations, constitute their sole financing.

Hydro-Electric Power to Aid Mining in the Belgian Congo.—Plans have been drawn up by the Société Minière Kilo-Moto for the establishment of a 10,000-hp. plant to utilize the water power of the River N'Zoro in the Belgian Congo. The power generated would operate the dredges used for raising the gold-containing gravel at the bottom of the River Kibali and for the treatment of the gold quartz at the Moto mines.

Pushing Work on Irrigation and Power Project on Salado River, Mexico.—Satisfactory progress is being made in the construction of the large Mexican irrigation and hydro-electric project on the Salado River near Cameron, in the State of Nuevo Leon, according to Enrique Silva, engineer, who is directing the work for the J. G. White Construction Company, which has the contract. The Mexican government is endeavoring to bring about the speedy completion of this enterprise. The irrigation system, including the large dam, will cost more than $4,000,000.

Hamilton, Ohio, Goes Ahead with New Municipal Plant.—Hamilton, Ohio, whose citizens voted in the fall of 1924 to reconstruct the municipal light and power plant rather than sell it to the Union Gas & Electric Company of Cincinnati, since which time there has been much agitation of the matter pro and con, has finally awarded a contract to the Westinghouse Electric & Manufacturing Company for equipment which will double the plant's present capacity of 1,000 kva. In addition there will be necessary the construction of a new building, bringing the total expenditure to approximately $525,000. Money is available from a bond issue in the sum of $650,000. Hamilton receives service also from the Cincinnati company's lines.

Idaho Concerned Over Delay on Government Plant at American Falls.—Failure of the United States Bureau of Reclamation to begin work on the government hydro-electric plant which is to be erected at American Falls on the Snake River in Idaho, coupled with reports that its construction is to be postponed for an indefinite period, is causing concern throughout southern Idaho. At the height of the irrigation season the Minidoka plant is taxed to its utmost capacity, and American Falls had been counted upon to provide "standby" service. All of the plans for the American Falls dam included the power plant as a necessary part of the project, and, as finally completed, penstock connections were provided for a 40,000-hp. installation. When Congress convened last December, Secretary Work recommended the appropriation of $1,500,000 for the plant. Ultimately $700,000 was appropriated.

Recent Court Decisions

De Forest Firm Loses Vacuum-Tube Appeal.—Through a decision handed down in Philadelphia by the United States Circuit Court of Appeals, the Radio Corporation of America won for the second time over the De Forest Radio Telephone & Telegraph Company in litigation over alleged infringement in the sale of vacuum tubes. The De Forest company claimed damages from the Radio Corporation on the ground that it had infringed a patent by Lee De Forest in selling vacuum tubes manufactured by the Westinghouse Lamp Company. Its original suit was dismissed by Judge Hugh M. Morris of the United States District Court of Delaware, who held that the Westinghouse Electric & Manufacturing Company and the Westinghouse Lamp Company, a subsidiary, had implied limited licenses from the General Electric Company, which held a manufacturing license from De Forest, to manufacture tubes for the Radio Corporation. This ruling is upheld.

Proximate Cause of Injury Is for Jury to Determine.—The trial judge gave a judgment of nonsuit in Ferro vs. Atlantic City Electric Company, a case where a fallen 2,200-volt wire lay on the street for two hours and was struck by an automobile and brought into contact with the plaintiff, to his injury, just as he was about to step over it. The reason given for not sending the case to the jury, was that the automobile was an intervening agency and that therefore the negligence of the company, if negligence were assumed, was not the proximate cause of the plaintiff's injury. The New Jersey Court of Errors and Appeals has overruled this finding, saying that the questions of proximate cause, negligence and contributory negligence in such a case were for the jury to decide. (137 At. 426.)*

Porto Rico Water-Power Law Sustained.—In reversing an inferior court, which declared the water-power law passed by the Porto Rico Legislature unconstitutional, the United States Circuit Court of Appeals (in Gallardo vs. Porto Rico Railway, Light & Power Company) found the law not invalid because it delegated legislative powers to the Commissioner of the Interior or imposed a tax for other than a public purpose. The commissioner's functions, the court held, under the act, were executive and administrative, and it was clear that the Legislature regarded the development of water power as involving special and peculiar benefits to the lands of the island. "Most kinds of personal property," the court said, "would obviously not be affected by increased availability of electric power and light or by water for domestic or irrigation uses, except as the general prosperity of the island might provide increased purchasing power for such personalty. But light, power and water made generally or largely available might well increase the agricultural productivity of the lands and also make large areas better fit for wholesome and comfortable residence. The scheme bears some analogy to the underlying theory of betterment assessments." (18 Fed. (2d) 918.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Commission Rulings

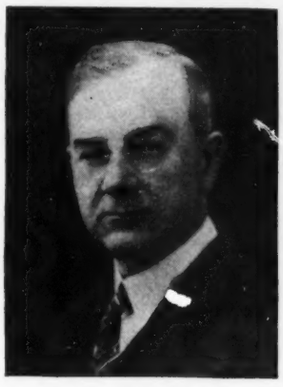
Company with Franchise Preferred Where Two Applicants Compete for Territory.—The Missouri Public Service Commission has given authority to the Empire District Electric Company to extend service into two villages which have granted it franchises and where the inhabitants appear to desire its service, notwithstanding that the Ozark Utilities Company had previously obtained authority from the commission to build a transmission line to one of these villages, since the latter company had taken no steps toward supplying the desired service.

Oregon Commission Condemns Brokerage in Sales of Utilities.—Brokerage as applied to the buying and selling of public utilities in Oregon is a practice not entirely approved by the Public Service Commission, and if business of this character is not more carefully regulated in the future, the commissioners intimate, a serious blow to the "customer-ownership" policy of financing service corporations may result. What the commissioners refer to in this informal expression of opinion is recurrent instances where speculative bartering in utilities has been followed by an inactive and negligent attitude on the part of the new and temporary operators and with attendant losses and inconveniences to customers in the form of inadequate service and exorbitant rates. In other words, the utilities speculator, the commission holds, is prone to acquire franchises in advantageous fields for future disposition to the major operating companies, in the meantime expending as little money as possible for the maintenance of whatever tangible properties may be included in the transaction. Another invariable practice of such speculators is immediately to bond newly acquired properties for double the amount for which they were purchased. Recent financing of this sort has been the source of wonderment to the commission, especially because properties financed in this manner fail somehow to avoid a display of red figures in reports filed with the state. It is not one of the commission's duties to regulate or supervise in any manner the methods or systems of utilities financing, but when there appears a situation where a utility is sold and the new operators are not only unable to realize profits but furnish service of still more inadequate character than afforded by the former owner, then, the commission holds, the state becomes officially and actively interested in the matter of finance.

Men of the Industry

T. F. English New President of Great Lakes Division

Thomas F. English, who was elected president of the Great Lakes Division of the National Electric Light Association, as already announced in the ELECTRICAL WORLD, has been vice-president and general manager of the Indiana & Michigan Electric Company at South Bend, Ind., since the fall of 1922. A native of Albany, N. Y., Mr. English early in his career became assistant electrical engineer of the



T. F. ENGLISH

State of New York after some years of experience in electrical work. The year 1908 found him in Kentucky in the employ of the United Light, Heat & Power Company of Covington. He severed his connection with that utility in 1910 to become vice-president and general manager of the Indiana General Service Company at Muncie. Mr. English has always taken an active part in association work, being a past-president of the Indiana Electric Light Association.

Earl G. Hines, well known in the electrical industry and affiliated fields, has resigned as vice-president of the American Brown Boveri Electric Corporation, Camden, N. J. Mr. Hines became identified with the American Brown Boveri organization in the spring of 1926, when he was appointed general sales manager in charge of general sales policies. From 1915 to 1926, with the exception of eighteen months in 1919 and 1920, he was connected with the McGraw-Hill Publishing Company, Inc., as Eastern manager of the ELECTRICAL WORLD and the *Industrial Engineer*. Early in his career Mr. Hines was sales manager for the Conger interests in central New York and subsequently joined the Harrison Williams organization, which engaged in public utility organization and finance.

W. R. Smith, formerly managing electrical engineer of the Public Service Production Company, Newark, N. J., has been appointed assistant chief engineer of that organization. Mr. Smith has been affiliated with the Public Service Corporation of New Jersey since 1914, when he entered the construction division of the engineering department of the Public Service Electric Company as an electrician. Since that time he has held the position of foreman of construction and field engineer in charge of construction in the engineering department of the Electric company. When the Public Service Production Company was formed in 1922 he was made superintendent of electrical construction, two years later being appointed managing electrical engineer.

A. C. Marshall, vice-president of the Detroit Edison Company, was elected president of the Detroit Board of Commerce at the recent annual election of officers.

C. O. Dunten, manager of the commercial department of the Central Illinois Public Service Company since 1917, has resigned to become manager of the commercial department of the Central & Southwest Utilities Company, with headquarters at Dallas, Tex. Mr. Dunten has been active in the affairs of the National Electric Light Association for ten years, having served as a member of the range committee for seven years, four years of which he was chairman. At the present time he is a member of the electric refrigeration committee and of the electrical advertising committee.

Seiiti Hirota, director of the Kobe Technical College, Kobe, Japan, and publisher of the *Ohm*, a Japanese electrical engineering magazine, is at present visiting in the United States. One of the foreign members of the National Electric Light Association and a government delegate to the Pan-Pacific Conference in Honolulu, Mr. Hirota has represented the Westinghouse company in Japan for twelve years.

F. M. Wilkes, general superintendent of the Arkansas Power & Light Company, Pine Bluff, has been named acting general manager in charge of the administration of all Arkansas properties. **C. S. Lynch**, superintendent of motive power, has been made head of the engineering and construction departments in addition. Mr. Wilkes has been advanced successively from commercial manager, operating superintendent and general superintendent to his new position.

C. J. Snyder to Leave for Brazil

C. J. Snyder, manager of the Duluth division of the Minnesota Power & Light Company, will sail on July 16 from New York on the steamer *Pan America* for Rio de Janeiro, Brazil. His new work will be in connection with the management of Brazilian properties owned by the American & Foreign Power Company, a subsidiary of the Electric Bond & Share Company. Mr. Snyder was graduated from Iowa State College, Ames, in 1909 and entered the employ of the Nebraska Power Company of Omaha. He rose to the position of chief engineer in this company and left in 1923, after completing a period of service covering fourteen

C. J. SNYDER

years, to be manager of the Duluth Edison Electric Company, which later became a part of the Minnesota Power & Light Company. Mr. Snyder has been active in association work, being the retiring president of the North Central Electric Association, a contributor to the work of several of the technical committees of the National Electric Light Association and a member of the American Institute of Electrical Engineers. His place as manager of the Duluth division of the Minnesota company will be taken by **H. J. Underhill**, now superintendent of power. **L. M. Pharis**, chief engineer of the company, has assumed the duties which were formerly performed by Mr. Underhill in the capacity of superintendent of power.

Obituary

Isaac E. Burcham, chief engineer at the Illinois Power & Light Company plant, Urbana, Ill., died June 18 at his home following a heart attack of a few moments' duration. Mr. Burcham was 64 years of age.

Prof. Charles F. Mabery, for many years head of the laboratory of the Standard Oil Company and a pioneer in electric furnace development, died recently at Portland, Me., at the age of 77.

Thomas M. McDermott, for many years connected with the Northern States Power Company of Minnesota and its predecessors, died June 20 at his home in St. Paul. Mr. McDermott was born in Stillwater, Minn., in 1876 and was graduated from the law school of the University of Minnesota in 1900. He became counsel for the Consumers Power Company of St. Paul, and when that company later became the nucleus around which the present system of the Northern States Power Company was drawn together Mr. McDermott found a wide field of activity. He was closely associated with Colonel H. M. Byllesby, J. J. O'Brien, Halford Erickson, Robert F. Pack, Charles Stuart and others who were concerned in the consolidation of companies that make up the Northern States system.

Emil Jorgenson, assistant secretary and assistant treasurer as well as general auditor of the Wisconsin Gas & Electric Company, died June 14 at his home in Racine. Mr. Jorgenson had been in the employ of the company for nineteen years.

Financial and Statistical

Common Stocks Recede

Bond Market Dull

Call Money Touches 5 Per Cent

A RISE in call money to 5 per cent on Tuesday halted the rally in trading on the New York Stock Exchange which followed the general decline on Monday and trading again became light. Prices of the electric light and power securities took a downward course and transactions in this field were in many instances at lower levels. Some utilities, however, showed strength. Among the losses were listed Brooklyn Edison, which fell to 163 from 167; Detroit Edison, which lost four points; Pacific Gas & Electric, Philadelphia Electric and the Public Service Corporation of New Jersey. The preferred issues held, the preferred stock index computed by the ELECTRICAL WORLD showing only a fractional loss.

Business in bonds was exceedingly dull, nothing appearing to shake off the languor characteristic of the market of late.

Central-Station Gains Continue

April Revenue Up 10.1 per Cent—Output Increased 11.3 per Cent—42.5 per Cent of the Total Energy Generated Is Hydro-Electric

MONTHLY statistics collected by the ELECTRICAL WORLD for the electric light and power industry indicate that the revenue for April, 1927, amounted to $145,300,000, an increase of 10.1 per cent over that of April, 1926. With the revised figures for the two preceding months, the returns for the three months show that progress has been consistently 10 per cent above that of the spring of 1926, after a slightly higher rate of advance for January. The higher percentage for January was evidently a reflection of the 12.6 per cent increase in energy output in December. The April gain in energy output, 11.3 per cent, compared with April, 1926, exceeded that of March by more than 1 per cent and forecasts a corresponding increase in the revenue for May.

The figures confirm the view expressed in the ELECTRICAL WORLD on June 4, in connection with the analysis of March operations, that the industry has settled down to a steady pace approximately 10 per cent above that of last year.

TABLE I—OPERATING RATIO OF CENTRAL-STATION COMPANIES

	Operating Ratio					
	Steam Plants		Hydro Plants		Combined Hydro and Steam Plants	
	1927	1926	1927	1926	1927	1926
Jan.	40.6	40.6	33.3	31.8	39.2	40.4
Feb.	42.7	42.2	37.4	36.5	39.6	40.8
Mar.	45.2	44.9	37.9	36.1	42.4	44.2
April	44.8	44.7	37.4	35.8	39.5	39.9

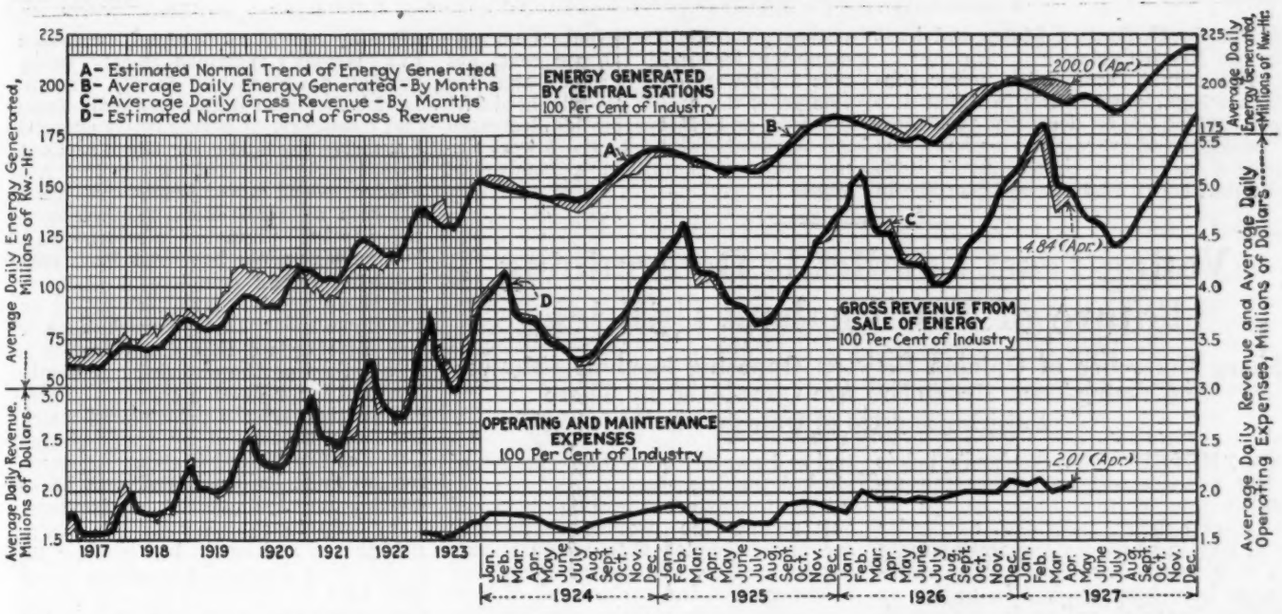
Regionally, the greatest gains in energy output occurred in the West South Central States, 30 per cent; the East South Central States, 17 per cent, and the South Atlantic States, 16 per cent. Both New England and the Far West show a distinct improvement over March when a comparison is made between 1926 and 1927 figures.

Correspondingly, the regional increase in revenue over April, 1926, was: New England, 7 per cent; Atlantic States, 11 per cent (more in the southern than in the northern portion); North Central, 9 per cent; South Central, 18 per cent; Mountain and Pacific States, 9 per cent.

While comparison with 1926 shows a continued growth, the well-established seasonal swing is in evidence, April output being almost invariably below

Security Issues of Electric Service Companies in June

Name of Company	Amount of Issue (Par Value)	Period Years	Class	Purpose	Interest Rate	Price	Per Cent Yield
Kansas Power & Light Co.	$3,286,000	30	First mortgage gold bonds, series B	To provide funds for acquisition of new properties and to reimburse the company for expenditures on additions	5	97½	[illegible]
Virginia Electric & Power Co.	3,000,000	28	First and refunding mortgage gold bonds, series A	To retire floating debt incurred for construction and other capital requirements	5	98½	5.[illegible]
Arkansas-Missouri Power Co.	340,000	26	First mortgage sinking-fund gold bonds	Acquisition of properties and for other corporate purposes	6	100	6
	200,000	..	Cumulative preferred stock		7	98	7.14
Electric Public Utilities Co.	4,000,000	15	Secured gold bonds	To provide funds for the acquisition of properties and for general corporate purposes	6	97½	6.25
Cities Service Power & Light Co.	6,956,250	..	Cumulative preferred stock	To reimburse treasury for advance made or to be made to its subsidiaries, for the acquisition of additional working capital and for other corporate purposes	6	92¾	6.47
Ohio Electric Power Co.	2,100,000	30	First mortgage gold bonds	To provide in part for the retirement of bonds at present outstanding against the property and in part to reimburse the treasury for money expended for the acquisition of properties	5	96	5.25
Midland Counties Public Service Corp.	2,500,000	30	First mortgage gold bonds, series A	To reimburse the treasury for funds expended for redemption of bonds and for expenditures for additions and improvements	5	96½	5.20
Iowa Public Service Co.	12,000,000	30	First mortgage gold bonds	To reimburse for retirement of securities, for improvement and extensions and for other corporate purposes	5	97½	5.16
Illinois Power & Light Corp.	4,000,000	29	First and refunding mortgage gold bonds		5	97	5.20
Minnesota Power & Light Co.	1,500,000	28	First and refunding mortgage gold bonds		5	99½	5+
Houston Lighting & Power Co.	2,000,000	26	First lien and refunding mortgage gold bonds, series A	To reimburse for expenditures on extensions and for other corporate purposes	5	99¾	5.03+
Utilities Power & Light Corp.	20,000,000	20	Gold debentures	To finance purchase of properties, to reduce current indebtedness, to retire underlying securities and for other corporate purposes	5½	94½	6
	3,000,000	..	Cumulative preferred stock		7	98	7.14
Wisconsin Michigan Power Co.	5,000,000	30	First and refunding mortgage gold bonds		5	99	5.06
Michigan Public Service Co.	2,000,000	20	First mortgage gold bonds, series A		5	96	5.32
Lake Ontario Power Corp.	1,000,000	30	First mortgage gold bonds	To retire bonds and for additions	5½	98	5.65
Total amount of issues	$72,882,250 (Par value)						
Total amount actually realized	$69,277,771						


A- Estimated Normal Trend of Energy Generated
B- Average Daily Energy Generated - By Months
C- Average Daily Gross Revenue - By Months
D- Estimated Normal Trend of Gross Revenue
ENERGY GENERATED BY CENTRAL STATIONS
100 Per Cent of Industry
GROSS REVENUE FROM SALE OF ENERGY
100 Per Cent of Industry
OPERATING AND MAINTENANCE EXPENSES
100 Per Cent of Industry
200.0 (Apr.)
4.84 (Apr.)
2.01 (Apr.)
Average Daily Energy Generated, Millions of Kw.-Hr.
Average Daily Revenue, Millions of Dollars
Average Daily Revenue and Average Daily Operating Expenses, Millions of Dollars
Average Daily Energy Generated, Millions of Kw.-Hr.
1917 1918 1919 1920 1921 1922 1923
1924 1925 1926 1927

March, because of the normal variation in lighting and—to a much less extent—in the railway load. This is accompanied by a similar decrease in revenue, but somewhat greater, because the drop takes place in the costliest part of the service.

Use of energy for industrial purposes appears to be steadily increasing. The estimated allocation of the total output indicates that this item amounted to about 100,000,000 kw.-hr. in January and 106,000,000 kw.-hr. in April.

The purchase of energy for resale also continues to grow, being about 23 per cent higher than a year ago. Reports of the companies on which these statistics are based, representing 89 per cent of the installed generator rating of the country, indicate that in this respect growth has been most marked

TABLE II—GENERATION AND DISTRIBUTION OF CENTRAL-STATION ENERGY IN THE UNITED STATES
(100 Per Cent of the Industry)

Month	Kw.-Hr. Generated Monthly *			Estimated Distribution of Energy Generated										Energy Purchased by Public Utilities for Resale, Kw.-Hr.	
				Total Energy Consumption by Central-Station Customers, Kw.-Hr.		Energy Consumed for Lighting, Kw.-Hr.		Energy Consumed for Power, Kw.-Hr.		Energy Sold to Electric Railways, Kw.-Hr.		Energy Used in Intracompany Business, Including Line Losses, Kw.-Hr.			
	1927 Thousands	1926 Thousands	Per Cent Inc.	1927 Thousands	1926 Thousands	1927 Thousands	1926 Thousands	1927 Thousands	1926 Thousands	1927 Thousands	1926 Thousands	1927 Thousands	1926 Thousands	1927 Thousands	1926 Thousands
January	6,303,199	5,683,055	+10.9	5,183,199	4,586,055	1,450,000	1,260,000	3,110,199	2,771,055	623,000	555,000	1,120,000	1,097,000	1,209,000	965,000
Feb....	5,706,468	5,190,645	+ 9.9	4,696,468	4,188,645	1,325,000	1,128,000	2,813,468	2,559,645	558,000	501,000	1,010,000	1,002,000	1,137,000	920,000
Mar....	6,312,005	5,727,028	+10.2	5,195,005	4,621,028	1,260,000	1,212,000	3,385,005	2,854,028	550,000	555,000	1,117,000	1,106,000	1,208,000	1,030,000
April...	5,998,724	5,389,573	+11.3	4,935,724	4,349,573	1,200,000	1,152,000	3,193,724	2,655,573	542,000	542,000	1,063,000	1,040,000	1,230,000	1,000,000

*Data on "energy generated" are those collected and published by the United States Geological Survey for all public utilities minus such data as are collected on energy generated by electric railway companies, reclamation service and manufacturing plants. The data are, therefore, for the electric light and power industry only.

TABLE III—CENTRAL-STATION FINANCIAL OPERATIONS FOR FOUR MONTHS IN THE UNITED STATES
(100 Per Cent of the Industry)

Month	Total Gross Revenue from Sale of Energy†			Estimated distribution of Gross Revenue								Total Operating and Maintenance Expenses‡	
				Lighting Customers		Power Customers		Electric Railways		Other Public Utilities			
	1927 Thousands	1926 Thousands	Per Cent Inc.	1927 Thousands	1926 Thousands	1927 Thousands	1926 Thousands	1927 Thousands	1926 Thousands	1927 Thousands	1926 Thousands	1927 Thousands	1926 Thousands
January..	$162,000	$145,100	+11.6	$102,000	$92,300	$43,200	$38,400	$5,800	$5,300	$11,000	$9,100	$63,900	$58,300
February.	152,600	138,500	+10.2	96,300	86,200	40,300	38,300	5,300	4,800	10,700	9,200	61,300	55,800
March....	146,300	133,000	+10.0	85,200	81,200	45,200	37,600	4,800	4,600	11,100	9,600	62,000	57,300
April.....	145,300	132,000	+10.1	84,900	80,800	44,900	36,600	4,900	4,900	11,600	9,700	60,300	54,900

†Aggregate gross revenue from actual consumers, and sales to other public utilities for resale, involving a certain amount of duplication.
‡Do not include interest, taxes, depreciation or sinking fund.

TABLE IV—OPERATIONS OF CENTRAL-STATION HYDRO AND FUEL PLANTS IN THE UNITED STATES*
(100 Per Cent of the Industry)

Month	Energy Generated						Fuel Consumption								
	Hydro-Plants			Fuel Power Plants			Coal			Oil			Gas		
	1927 Thousands of Kw.-Hr.	1926 Thousands of Kw.-Hr.	Per Cent Increase	1927 Thousands of Kw.-Hr.	1926 Thousands of Kw.-Hr.	Per Cent Increase	1927 Short Tons	1926 Short Tons	Per Cent Increase	1927 Barrels	1926 Barrels	Per Cent Increase	1927 Thousands of Cubic Feet	1926 Thousands of Cubic Feet	Per Cent Increase
January...	2,331,140	1,928,775	+20.9	3,972,059	3,754,280	+ 5.8	3,365,461	3,272,761	+2.8	786,062	972,131	—19.1	3,900,868	3,661,363	+ 6.5
February..	2,172,740	1,886,471	+15.2	3,533,728	3,304,174	+ 6.9	2,958,797	2,886,534	+2.5	646,558	683,580	— 5.4	3,859,791	3,328,365	+15.9
March....	2,548,920	2,237,457	+13.9	3,763,085	3,489,571	+ 7.8	3,093,720	3,071,092	+0.7	613,466	670,248	— 8.4	4,317,007	3,899,085	+10.7
April.....	2,488,779	2,279,976	+ 9.2	3,509,945	3,109,597	+12.9	2,934,094	2,742,058	+7.0	541,119	600,368	— 9.8	4,405,855	3,465,746	+27.1

*As collected by United States Geological Survey. The data are for the electric light and power industry only.

in the South Central States and least in the North Central.

The output from water power continues high, constituting in April 41.5 per cent of the total energy generated. The output of hydro-electric plants was 9.2 per cent above that of April, 1926, compared with 12.9 per cent increase in energy generated from fuel. Coal consumption increased 7.0 per cent, but was the lowest of any month thus far this year; the use of gas increased 27.1 per cent, and oil consumption decreased 9.8 per cent, falling to the lowest figure for any month in a number of years.

Voting-Trust Conflict Is Determining Future of New England Utilities

Sharp Difference of Opinion Between Opposing Factions—Motives of Voting-Trust Promoters Are Questioned by Those Favoring Ingress of Outsiders

WHETHER New England's public utilities will be further consolidated into a few large groups or whether existing individual companies will remain as separate operating units is now being determined. The crossroads have been reached in so far as future financial policy is concerned. Advocates of the former policy are the large power groups both outside and inside New England. Favoring a policy of *status quo* are certain groups and individual companies within New England that would perpetuate present control and ownership by the formation of stock-depositing trusts.

The circumstances leading up to and surrounding the present controversy are more complex than would appear on the surface. Without a knowledge of the growth and background of New England's public utilities, and possibly also of New England's business viewpoint in general, an adequate understanding of the situation is impossible. Utilities in this area have developed along lines essentially different from those elsewhere. Financed locally, often by capital stock alone, ownership has largely remained local, being handed down within family groups. Legislation also differs radically from that elsewhere. It is frequently charged by utility executives in other sections that conservative and safe policy has always been more pronounced than business aggressiveness. Interconnection has been promoted in a large way, but managements have not been consolidated on as complete a scale as elsewhere. Rates have been based on the "investment" theory, which more or less disregards a changing price level, rather than on the elsewhere generally accepted "reproduction cost less depreciation theory," the principle of which has been sanctioned by the Supreme Court of the United States. All these factors must be considered as a background for the present controversy. They help to explain why the power groups are seeking to buy and tie together New England properties. They also help to explain why certain interests are endeavoring to exclude the large groups.

The voting trust, which is the medium used by those opposed to the large groups, is in itself simple. The first step in its formation is to secure the promise of holders of at least a

Stock Quotations of Electric Light and Power and Manufacturing Companies

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies	Bid Price Tuesday June 28	Low 1927	High 1927
ABITIBI PWR. & PAPER, 4% com.—no par	93¼	83	97¼
Adirondack Pwr. & Lt.—7% pf.	109	107	111½
Adirondack Pwr. & Lt.—8% pf.	114	112	115
Ala. Pwr., $7 cum. pf.—no par	110½	107	112½
Allis-Chalmers Mfg., 7% pf.	k111¼	109	112½
Allis-Chalmers Mfg., 6% com.	103¾	88	111¼
Aluminum Co. of Amer., com.	78	67¼	81¼
Aluminum Co. of Amer., 6% of	m104	101¼	104½
Amer. & Foreign Pwr., pf. 25% pd.	m110	....	....
Amer. & Foreign Pwr., 7% pf.—no par	100½	86½	102
Amer. & Foreign Pwr., com.—no par	21¼	18¼	25¼
Amer. Bosch Magneto, com.—no par	15½	13	18¼
Amer. Brown Boveri Elect.	15½	12	39½
Amer. Brown Boveri Elec., pf. $7	k 60	50½	98
Amer. Gas & Elec., 6% pf.—no par	101¼	95½	105½
Amer. Gas & Elec., com.†—no par	87½	68½	100½
Amer. Lt. & Trac., 6% pf.	115	112	120
Amer. Lt. & Trac., com.†	257	222	265
Amer. Pwr. & Lt., 6% pf.	101½	97½	106½
Amer. Pwr. & Lt., com.†—no par	60	54	67
Amer. Pub. Serv., 7% pf.	a 99	94	104
Amer. Pub. Serv., com.†	65	....	....
Amer. Pub. Utilities, 7% ptc. pf.	k 87	73	88
Amer. Pub. Utilities, 7% pr. pf.	94	88	93
Amer. Pub. Utilities, com.	57	65	70
Amer. States Sec., A	3	2½	4½
Amer. States Sec., B	3	2½	4½
Amer. Superpwr., 6% ptc. pf.—25	29½	26½	29½
Amer. Superpwr., 6% 1st pf.	l 95	....	....
Amer. Superpwr., Class A†—no par	36	27½	38¼
Amer. Superpwr., Class B†—no par	36½	28¼	39½
Amer. Wtr. Wks. & Elec., 7% pf.	110½	105	111¼
Amer. W. W. & E., com. $1.60—20	89½	62½	98
Anaconda Copper cap. $3	42	41¼	49½
Appalachian Electric Pwr., 7% pf.	102	100	105
Appalachian Elec. Pwr., 7% 2nd pf.	101	100	102
Appalachian Elec. Pwr., com.	m78	....	....
Arizona Pwr., 7% pf.	81	77	84½
Arizona Pwr., com.	22	....	....
Arkansas Pwr., & Lt. 7% pf.	101½	....	....
Assoc. Gas & Elec., $3.50—50	51	....	....
Assoc. Gas & Elec., pf.—$6—no par	92	85	93
Assoc. G. & E., Class A, 10—no par	40½	35	43
BABCOCK & WILCOX, 7% com.	116	115	123
Binghamton L., H. & P., $6 pf.	97	93	98
Birmingham Elec., pf.—$7—no par	107½	105	109
Blackstone Valley G. & E., 6% pf.	106	103	105
Blackstone Valley Gas & Elec., 10% com.—50	133	98	153
Blaw-Knox, com.†	l 71	70	73
Brazilian Trac., Lt. & pwr., com.†	/156½	....	....
Broad River Pwr., 7% pf.	101	97	100
Brooklyn Edison, 8% com.	163	148½	176
Buffalo, Niagara & East. Pwr., $1.60 pf.—25	l 25½	....	....
Buffalo, Niagara & East. Pwr. com. $1—no par	l 31½	....	....
CALIFORNIA ELEC. GENERATING, 6% pf.	97	96	99½
California Ry. & Pwr., 7% pf.	135	125	150
Carolina Pwr. & Lt., pf.—$7—no par	l108	107	108½
Central & S.W. Util., $7 pf.—no par	a 97	93¼	97½
Central & S.W. Util., pr.ln.$7 pf.—no par	a101	98½	103
Central Ariz. Lt. & Pwr., 8% pf.	k 97	95	98
Central Ark. Ry. & Lt., 7% pf.	102	100	104
Central Ill. Pub. Serv., $6 pf.	a 92	88½	95½
Central Ind. Pwr., 7% pf.	91	86	95
Central Pwr. & Lt., 7% pf.	102	100½	103
Central States Elec., 7% pf.	96	93	96
Central States Elec., com.†	m200	....	....
Century Elec., 6% com.	m115	115	115
Chicago Fuse Mfg., com.—$2.50 no par	m 35	30	35
Cincinnati Gas & Elec., 5% com.	g 98½	....	....
Cities Service, 6% pf.	l 87½	87½	92½
Cities Service, pf. B—10	l 8½	8	8½
Cities Service, pf. BB—100	l 82½	80½	85
Cities Service, com.—20	l 45½	40½	58½
Cities Service, Bks. Shrs.—10	l 22½	22½	29½
Clarion River Pwr., 8% pf.	95	....	....
Cleveland Elec. Illg., 6% pf.	110½	108	110
Cleveland Elec. Illg., 10% com.	k 300	285	310
Columbia Gas & Elec., 6% pf.	104½	99½	107½
Columbia G. & E. com. $5—no par	92½	82½	98½
Columbia Ry., Gas & Elec., 6% pf.	m 94	....	....
Columbus Elec. & Pwr., $2 com.—no par	65	....	....
Columbus Ry., Pwr. & Lt., 6% 1st pf.	101½	98½	102½
Columbus Ry., Pwr. & Lt., 6½% pf. B	102	96	103½
Columbus Ry., P. & L., com.—no par	90	75	79
Commonwealth Edison, 8% com.	a150½	138	155
Commonwealth Pwr., 6% pf.	98½	91½	100
Commonw'th Pwr., $2, com.—no par	52½	48½	54½
Conn. Lt. & Pwr., 8% pf.	k120	119	123
Conn. Lt. & Pwr., 7% pf.	k113	112	113½
Cons. Gas of N. Y., pf.†—50	m 56½	55½	62½
Cons. Gas of N. Y., com $5—no par	101	94	109½
Cons. Gas, Elec. Lt. & Pwr. of Balti., 6% pf.	e108	106½	108½
Cons. Gas, Elec. Lt. & Pwr. of Balti., 6½% pf.	e112	110½	112½
Cons. Gas, Elec. Lt. & Pwr. of Balti., 7% pf.	e114	112½	115½
Cons. Gas, Elec. Lt. & Pwr. of Balti., 8% pf.	e128½	126	128
Cons. Gas, Elec. Lt. & Pwr. of Balti., com. $2.50—no par	e 57½	51	59½
Consolidated Pwr. & Lt., 7% pf.	k105	100	106
Consumers Pwr., 6% pf.	102	100	102
Consumers Pwr., 6.6% pf.	105	103	105½
Continental Gas & Elec., 8% ptc. pf.	105	103	106½
Continental Gas & Elec., 7% pr. pf.	102	100	103
Conti. G. & E. com. $4.40—no par	k210	210	225
Crocker Wheeler, com.†	25	30	38
Crocker Wheeler, 7% pf.	83	78	88
DALLAS PWR. & LT., 7% pf.	108½	107	109½
Dayton Pwr. & Lt., 6% pf.	k105½	101	103
Detroit Edison, 8% com.	k143½	133½	157
Dubilier Condenser, com.—no par	4½	3½	5½
Duquesne Lt., 7% pf.	116	114½	116½
EASTERN NEW YORK UTIL., $7 pf.	105	102	104½
Eastern New York Util. com.	65	70	75
Eastern States Pwr., $7, com.	8	9	13
Eastern States Pwr., pf.	88	90	95
East. Tex. Elec., 7% pf.	107	106	108
Edison Elec. of Boston, $12 com.	d244	217	267
El Paso Elec., 7% pf.	109	105	107½
Elec. Bond & Share, 6% pf.	l107½	105½	109½
Elec. Bd. & Sh. Sec., com. $1—no par	l 70½	67½	76½
Electric Household Util.†	a 13½	11	15½
Elec. Investors, 6% pf.—no par	93½	92	96
Elec. Investors, com.†—no par	36½	32½	40½
Elec. Investors, 10% pd. receipts	m 15	....	....
Elec. Pwr. & Lt., ctfs. pf.	102½	96	106½
Elec. Pwr. & Lt., ctfs., 40% pd.	k113	103½	115
Elec. Pwr. & Lt., ctfs., full pd.	m114½	108½	111½
Elec. Pwr. & Lt., ctfs., com.—no par	21½	16½	23½
Elec. Refrig. cap.†	18½	18	37½
Elec. Ry. Securities, com.—no par	7½	6	8
Elec. St. Battery com. $5.25—no par	65½	63½	79½
Elmira Wtr., Lt. & R.R., 7% pf.	101	99	101½
Emerson Elec., pf.	m111	108½	111
Empire Pwr., ptc.†	36	26	38½
Engr. Pub. Serv., $7 pf.—no par	103½	93½	106½
Engr. Pub. Serv., com.—no par	25½	21½	28½
Eureka Vacuum Cleaner, com. $4—no par	71½	60½	74½
FAIRBANKS MORSE, 7% pf.	k110	107½	112
F.-M., com.—$3—no par	38½	37½	43½
Federal Lt. & Trac., com. $1.40	42	37½	47
Federal Lt. & Trac., $6 pf.—no par	k 97	91½	99½
Ft. Worth Pwr. & Lt., 7% pf.	l111	108	112
GALVESTON-HOUSTON ELEC. 6% pf.	67	68	72
Galveston-Houston Elec., com.	30	28	32
Gen. Elec., $3 com.—no par	105½	81	108½
Gen. Elec., special—6%	11½	11	11½
Gen. Gas & Elec. (Del.) com. A, $1.50—no par	39½	34	47½
Gen. G.&E. (Del.) com. B—no par	m 42	35½	43½
Gen. G.&E. (Del.) pf. A, $8—no par	k117	113½	120
Gen. G.&E. (Del.) pf. A $7—no par	106½	100	109½
Gen G.& E. (Del.) pf. B $7	k103	96	105
Gen. Pub. Serv., $7 conv. pf., no par	k107½	102	106
Gen. Pub. Serv., com., no par	m 14½	11½	15½
Ga. Lt., Pwr. & Rys., 6% pf.	95	87	92
Ga. Lt., Pwr., & Rys., com.	45	....	....
Ga. Ry. & Pwr., 8% pf.	k123	119	123
Ga. Ry. & Pwr., 7% pf.	k113½	106	110
Gt. Western Pwr., 7% pf.	h102	....	....
IDAHO PWR., 7% pf.	107	103	105
Ill. No. Utilities, 6% pf.	a 96	92	97
Ill. Pwr. & Lt., 7% pf.	99	99	101
Ingersoll Rand com. $8	k 89	89½	96½
Int. Combus. Engr., com. $2—no par	46	43½	64
Int. Util., Class A—$3.50—no par	40½	28	41½
Int. Utilities, Class B—no par	6½	3	7½
Interstate Pwr., pf.—$7—no par	94½	93	98
Interstate Pub. Serv., 7% pf.	100	98	99½
Iowa Ry. & Lt., 7% pf.	98	97	99
JERSEY CENTRAL PWR. & LT. CO., 7% pf.	100	97½	103
Johns-Manville, com.†—no par	79½	55½	86

Stock Exchange: aChicago; bSt. Louis; cPhiladelphia; dBoston; eBaltimore; fMontreal; gCincinnati; hSan Francisco; iPittsburgh; jWashington. kBid price Saturday, June 25. lBid price Wednesday, June 29. mLatest quotations available. †Dividend rate variable.

Stock Quotations of Electric Light and Power and Manufacturing Companies (Continued)

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies	Bid Price Tuesday June 28	Low 1927	High 1927
KANSAS CITY PWR. & LT. pf.$7	k114¼	112	115¼
Kansas Gas & Elec., 7% pf.	l105	103	107
Kentucky Hydro-Elec., 7% pf.	a 97	94¼	97½
Kentucky Sec.,6% pf.	k 86	83	87
Kentucky Sec.,5% com	109½	110	115
Kentucky Utilities, 6% pf.	98	95	98½
Keystone Pwr. & Lt., 7% pf.	98	96½	100½
LACLEDE GAS LT., 12% com.	231	173½	267½
Lehigh Pwr. Sec., com.—no par	18½	15	20
Long Island Ltg., 7% pf.	108½	107	112
Long Island Ltg., com.†—no par	142	139	153
Los Angeles Gas & Elec., 6% pf.	100	98	100½
Louisville Gas & Elec., cl. A. $1.75	26	23½	27½
MAN. ELEC. SUPPLY, cap. $5 —no par	76½	53½	77½
Manila Elec., com.†—no par	k 43½	40	46
Maytag Mfg., com. .50—no par	29½	23½	32½
Memphis P. & L., pf.—$7—no par	107	107	109
Metropolitan Ed., pf.—$6—no par	98½	93	100
Metropolitan Ed., pf.—$7—no par	106	104	108
Metropolitan Ed., com. $5—no par	67	....	....
Middle West Utilities, 7% pf.	a110½	105½	113½
Middle West Util., 8% pr. lien	a120	117½	122½
Middle West Util., com. $6—no par	a111½	108	117½
Midland Utilities, pr. ln. 7% pf.	a101½	92½	103
Midland Utilities, 7% pf. A	a 94½	92½	94½
Milwaukee Elec. Ry. & Lt., 7% pf.	k102	100	103
Milwaukee Elec. Ry. & Lt., 6% pf.	k 98	98	101½
Minn. Pwr. & Lt., 7% pf.	l105	104	107
Miss. Pwr. & Lt., $8 pf.	m114	106	111
Miss. River Pwr., 6% pf.	98½	94	97
Miss. River Pwr. 3% com.	62	....	....
Mohawk Hudson Pwr., 1st pf.—$7 —no par	k107½	100	109
Mohawk Hudson Pwr., 2d pf.—$7 —no par	k108	98	109
Mohawk Hudson Pwr., com.—no par	24½	20½	27
Montana Pwr., 7% pf.	m121½	118½	123
Montana Pwr., 5% com.	97½	81½	104½
Montreal Pwr., 7% com.	f 84	....	....
Mountain States Pwr., 7% pf.	100½	97	101
Mountain States pwr., com.†	19	....	....
NASSAU & SUFFOLK LTG., 7% pf.	106	98	105
National Carbon, 8% pf.	a 137	130½	137½
National Elec. Pwr., A†	a 24½	23½	25½
National Lt., Ht. & Pwr., com.	24	....	....
National, Light, Ht. & Pwr., 8% pf.	70	....	....
National Pwr. & Lt., pf.—$7—no par	k104	101	108½
National Pwr. & Lt., com.†—no par.	21½	19½	23½
National Pub. Serv., 7% pf.	k 98	93	100
National Pub. Serv., 7% pfe., pf.	113	108	115
National Pub. Serv., A com. $1.60— no par	21½	18½	24
National Pub. Serv., B com.—no par	k 19	14	20½
Nebraska Pwr., 7% pf.	l108½	106	108½
Nevada-Calif. Elec., com.	m 28½	25	31
New Brunswick Pwr., 4% pf.	55	....	....
New Eng. Pub. Serv., pr. ln. pf. $7..	100	98½	101
New Eng. Pub. Serv., pf. $7.	97	95	97½
New Orleans Pub. Serv.—7% pf.	103	103	105½
N. Y. & Queens Elec. Lt. & Pwr., 5% pf.	k 92	91	95
N. Y. Central Elec., 7% pf.	k103	102	104
Newport News & Hampton Ry., Gas & Elec., 5% com.	109	....	....
Newport News & Hampton Ry., Gas & Elec., 7% pf.	109	....	....
Niagara Falls Pwr., 7% pf.—25.	k 28½	27½	29½
Niagara, Lock. & Ont. Pwr., 7% pf.	111	110½	113
No. Amer., 6% pf.—50.	51½	50	52½
No. Amer., com.—10	48½	45½	52½
No. Amer. Edison, $6 pf.—no par	100	96½	101½
No. Caro. Pub. Serv., pf.—$7—no par	101	93	100
Northeastern Pwr., com.	16½	14½	18½
No. Indiana Public Service, 7% pf. A.	104½	102	104
No. N. Y. Utilities, 7% pf.	105½	103	109
No. Ohio Pwr., com.—no par	11½	9½	13½
No. Ohio Trac. & Lt., 6% pf.	83	78	81
No. Ohio Trac. & Lt., 7% pf.	93	90	93
No. Ont. Lt. & Pwr., 6% pf.	k 94	84	95
No. Ont. Lt. & Pwr., 4% com.	74	73	78
No. States Pwr., (Del.) 7% pf.	105½	101	107½
No. States Pwr., (Del.) 8% com.	117½	109½	124
No. Texas Elec., 6% pf.	k 66	65	70
No. Texas Elec., com.	22	27	36
OHIO BRASS, com. B $4—no par.	83	74	85
Ohio Brass, 6% pf.	105	100	105
Ohio Pwr., 6% pf.	102½	96	103
Ohio Pub. Serv., $6 pf.	98	95	96½
Ohio Pub. Serv., 7% pf.	107½	103	109
Ohio River Edison, 7% pf.	107	103	109½
Oklahoma Gas & Elec., 7% pf.	100	...	....
PACIFIC GAS & ELEC., 6% pf.	26½	24½	26½
Pacific Gas & Elec., 8% new com.	36½	31	39½
Pacific Pwr. & Lt., 7% pf.	l104	102	104
Penn Cent. Lt. & Pwr., $5 pf.—no par ex. div.	c 75	71½	75
Penn-Ohio Edison, 7% pf.	102	97½	104½
Penn-Ohio Elec., 7% pf.	99	98	100
Penn-Ohio Pwr. & Lt., 7% pf.	105	99	103
Penn-Ohio Pwr. & Lt., 8% pf.	115	109	113
Penn Pwr.& Lt.—$7—no par.	l108	107	108½
Penn Wtr. & Pwr., 8% com., new	c 47½	47½	49
Phila. Co., 6% pf.—50.	k 51½	50	53
Phila. Co., com.—50	k100	85½	110
Phila. Elec., 8% com.—25	c 50	46½	54
Portland Elec. Pwr., 7% pf.	98	97½	101
Portland Elec. Pwr., 6% pf.	k 77	78	83
Portland Elec. Pwr., 6% 2d pf.	55	55	70
Portland Elec. Pwr., com.	24	22	30
Potomac Elec. Pwr., pf.	m108½	....	....
Pwr. Corp. of N. Y., com. $1—no par	m 79	....	....
Pwr. Sec., pf.—no par.	k 28	28	33
Pwr. Sec., com.—no par.	k 6	5	8
Public Serv. of Colorado, 7% pf.	l100	99	100
Pub. Serv. of N. J., 6% pf.	k 99½	98½	101½
Pub. Serv. of N. J., 8% pf.	k130	125	132
P. S. of N. J., $2 com.—no par.	40	32	45½
Pub. Serv. of No. Ill., 6% pf.	a103½	101½	105½
Pub. Serv. of No. Ill., 7% pf.	m115½	112½	116½
P. S. of No. Ill., com. $8—no par	a141	130½	143
Pub. Serv. of No. Ill., $8 com.	a141	132	142
Pub. Serv. of Okla., 7% pr. ln.	100	99	100½
Pub. Serv. Elec. & Gas, 6% pf.	106½	102	108½
Puget Sound Pwr. & Lt., 7% pr. pf.	108	105	107
Puget Sound Pwr. & Lt., $6 pf.—no par.	85	....	....
Puget Sound Pwr. & Lt., com.	31½	28	35½
RADIO CORP. OF AMER., $3.50 pf.—50.	51½	49	53
Radio Corp. of Amer., com.—no par.	54½	41½	56½
Republic Ry. & Lt., pf.	k120	....	....
Republic Ry. & Lt., com.	k135	112	135
Rochester Gas & Elec. 6% pf. D.	k104	101	103½
Rochester Gas & Elec., 7% pf. B	106	105	107
Rochester Gas & Elec., 6% pf. C.	104	101½	103½
SAFETY CABLE, com. $4.	72½	52½	72½
San Joaquin Lt. & Pwr., 7% pr pf	106	105	108
St. Joseph Ry., L., H. & P., 5% pf.	72	70	73
Servel Corp.	4	3½	10½
Sierra Pacific Elec., 2% com.	k 26	26	28½
Sioux City Gas & Elec., 7% pf.	102	99	104
Southeastern Pwr. & Lt., pf.—$7 no par	k109	101½	109
Southeastern Pwr. & Lt., pfe. pf.	l 78½	....	....
Southeastern Pwr. & Lt., com.—no par.	34½	29½	38½
So. Calif. Edison, 8% pf.	36	36½	38
So. Calif. Edison, 7% pf.	28½	27½	28½
So. Calif. Edison, 6% pf.	25	24½	25½
So. Calif. Edison, 8% com.	34½	31½	36½
Southern Cities Utilities, 7% pf.	75	81	86½
Southern Cities Utilities, com. $4.	m 37	....	....
Southwestern Lt. & Pwr., A $3.	k 65	60	65
Southwestern Lt. & Pwr., B.	k 65	60	65
Southwestern Lt. & Pwr., $6 pf.	k 84½	83	91½
Southwestern Pwr. & Lt., 7% pf.	k109	103	110½
Springfield (Mo.) Ry. & Lt., 7% pf	102	95	102
Standard Gas & Elec., 8% pf.	62½	57½	64
Standard Gas & Elec., 7% pr. pf.	108½	103	110
Standard G. & E., com. $3.50—no par	59½	54	65½
Standard Pwr. & Lt., 7% pf.	101	98	102½
Staten Island Edison, pf.—$6—no par.	k100	99	101
Superheater, $6 com.—no par.	175	170	185
Syracuse Lighting, 7% pf.	105½	103	107
Syracuse Lighting, 8% pf.	115	....	....
Syracuse Lighting, 8% com.—no par	300	....	....
TAMPA ELEC., com. $2.	k 59	49	64
Tenn. Elec. Pwr., 6% pf.	95½	92	97
Tenn. Elec. Pwr., 7% pf.	105½	103	106½
Terre Haute, Ind. & East. Trac., 5% pf.	20	20	25
Terre Haute, Ind. & East. Trac., com	1	1	3
Tex. Pwr. & Lt., 7% pf.	l109	106	108½
Tide Water Pwr., 8% pf.	107½	105	108½
Timken Roller Bear., com.—$4 no par.	100½	78	106½
Toledo Edison, 8% pf.	k115	115	118
Toledo Edison, 7% pf.	l106½	104	106½
Toledo Edison, 6% pf.	k 98	95	97
Toledo Edison, 6% com.	100	....	....
Tri-City Ry. & Lt., 6% pf.	96	90	97
UNITED GAS & ELEC., 6% pf.	k100	98	102
United Gas & Elec., com.—no par.	m 57	....	....
United Gas & Elec. (N. J.) 5% pf.	72	70	73
United Gas Impr., 8% com.—50.	c103	89½	108½
United Lt. & Pwr., pf.—$4—no par.	51	49	53½
United Lt. & Pwr., pf.—$6.50—no par.	95½	87	97½
United L. & P., com. A .48—no par.	13½	12½	15½
United L. & P., com. B .48—no par.	a 17	15	18
Utah Pwr. & Lt., 7% pf.	l106½	104	108½
Utica Gas & Elec., 7% pf.	106½	105	106½
Utica Gas & Elec., 8% com.	200	....	....
Utilities Pwr. & Lt., 7% pf.	95½	93	100
Utilities Pwr. & Lt., com. A $2.	30	27	34
Utilities Pwr. & Lt., com. B $1—no par.	17½	13½	19
VERMONT HYDRO-ELEC., 7% pf.	97	95	97½
Virginia Elec. & Pwr., 7% pf.	107	105	107
Virginian Pwr., 7% pf.	108	....	....
Virginian Pwr., com.	70	....	....
WAGNER ELEC., 7% pf.	b 88	68	90
Wagner Elec., com.—no par.	b 35	18½	39½
Washington Ry. & Elec., 5% com.	250	....	....
Washington Ry. & Elec., 5% pf.	m 91½	....	....
Washington Wtr. Pwr., 8% com.	155	136	160
West Penn Elec., 7% pf.	110½	102	110½
West Penn Elec., Cl. A $7.	106	97½	110
West Penn Pwr., 7% pf.	114½	111	118
West Penn Pwr., 6% pf.	m107	100½	108
West Virginia Lt., Ht. & Pwr., 7% pf	90	94	96
West Va. Utilities, 7% pf.—50.	51	48	51½
Western Pwr., 7% pf.	101	97½	102
Western States Gas & Elec., 7% pf.	k101	96	100½
Western States Gas & Elec., com.	24	....	....
Westinghouse Elec. & Mfg., 8% com. —50.	73½	67½	77½
Weston Elec. Instrument, Cl. A $2 —no par.	13½	13½	34½
Weston Elec. Instrument, com.—no par.	k 14½	14½	18½
Wheeling Elec., 6% pf.	101	95	97
Worthington Pump, 7% pf. A	k 57	46	61½
Worthington Pump, 6% B.	k 48	40	54½
Worthington Pump, com.	37½	20½	46
YALE & TOWNE com. $5—25.	k 80	70½	81

Stock Exchange: *a*Chicago; *b*St. Louis; *c*Philadelphia; *d*Boston; *e*Baltimore; *f* Montreal; *g*Cincinnati; *h*San Francisco; *i*Pittsburgh; *j*Washington. *k*Bid price Saturday, June 25. *l*Bid price Wednesday, June 29. *m*Latest quotations available. †Dividend rate variable.

majority of the stock to enter the trust. When such an amount has been assembled, it is locked up under a trust agreement which provides for the appointment of certain trustees who retain the sole voting power for the group. In exchange for their stock the shareholders receive certificates of ownership and, of course, retain the right to such dividends as are paid, as before. Since one alleged element in the purpose of the voting trust is to prevent the sale of stock or of the property at an unduly low price, provision is made for a minimum price below which no stock shall be sold. Such a price is usually well above the market, being placed sufficiently high to provide for a material appreciation in the value of the stock during the subsequent period. In nearly all cases there is a time limit to the life of the trusts, although they are sometimes subject to extension. Certain Massachusetts trusts continue until 1950.

As stated in last week's issue, those back of the voting-trust movement urge that the only purpose of their action is to protect shareholders from the encroachment of outside interests that are seeking to secure control of the companies concerned and whose policy, it is alleged, may differ radically from that of the old management. Those on the other side of the issue are inclined to question this motive rather seriously. The executive head of one of the "outside groups" points out that those behind the voting-trust movement frequently hold only a small proportion of the stock of the companies involved. He argues that if the alleged motive were the only one, a trust of very short duration would be adequate. He also suggests that the reference to outside executives unfamiliar with New England methods utterly fails to hold water in view of the fact that leading executives in important positions today frequently had their training in opposite corners of the country to those in which they have ultimately settled. It is questioned by certain interested parties whether or not the legality of at least some of the existing voting trusts would be sustained by the courts, should litigation arise. It is urged by those seeking to acquire New England properties that vast economies could be introduced, as in other sections of the country, by consolidation of management and finances of many of the smaller companies.

What the outcome will be depends on a variety of circumstances. The problem of valuation and rates will probably play a large part. An executive of one of the buying groups stated that rate reductions were contemplated in the case of each of the properties acquired. If such a policy is general, the picture is in conflict with the suggestion that "outsiders" are paying high prices with the intention of making up for them by raising rates.

Manufacturing and Markets

Wiring Electric Ranges

Technical Sub-Committee Appointed to Formulate Complete Rules for 1928 Electrical Code

IN FEBRUARY the electrical committee of the National Fire Protection Association approved the suggestion of A. R. Small, chairman of the committee, that a technical sub-committee be created to report, if possible to the 1928 meeting and in some detail, on rules to appear in the next edition of the National Electrical Code and covering completely the subject of "Wiring of Electric Ranges." It has been found that a substantial diversity of practice exists in various localities with respect to such wiring. One such item is the use and location of a switch controlling the range circuit. In accordance with this approval the technical sub-committee has been appointed to study the subject.

The technical sub-committee has been requested to give consideration to the entire subject of the installation of suitable circuits for supplying energy to electric ranges under conditions generally contemplated within the National Electrical Code. The committee will also make recommendations for a text in the code, presumably a special new section of Article 16. These recommendations should be filed with the committee on Article 16 during the late fall this year, and in time for it to determine whether or not it can sponsor the recommendations and forward them on or about Dec. 1, 1927, as an official report of the article committee for action by the electrical committee at its February, 1928, meeting.

Frank Thornton, Jr., of the Westinghouse Electric & Manufacturing Company, and one of the representatives of the heating appliance section of the National Electrical Manufacturers' Association, will act as chairman of this technical sub-committee pending its initial meeting when the members can organize and select another chairman if they then so desire. The report of the committee, when rendered, will be made to W. S. Boyd, chairman of the committee on Article 16, at 175 West Jackson Boulevard, Chicago. The electrical field secretary, W. J. Canada, will also assist the committee if desired.

In addition to the following members of the sub-committee a representative from the Canadian electrical inspectors' group will also be named: A. P. Good, Commonwealth Edison Company, Chicago; Alexander Maxwell (alternate), National Electric Light Association, and H. B. Whiteman, Hodenpyl, Hardy & Company, Inc., representing National Electric Light Association; W. Creighton Peet, Peet & Powers, New York, representing Association of Electragists International; H. J. Mauger, Edison Electric Appliance Company, Chicago; F. W. Hewitt, Simplex Electric Heating Company, Cambridge, Mass., and Frank Thornton, Jr., Westinghouse Electric & Manufacturing Company, representing National Electrical Manufacturers' Association; H. B. Smith, Underwriters' Laboratories, New York, and H. M. Obergfell, Underwriters' Laboratories, Chicago, representing Underwriters' Laboratories; W. W. Vaughn, New York State Fire Insurance Rating Organization, Syracuse, N. Y., representing Eastern Association of Electrical Inspectors; L. A. Barley, Denver, representing Western Association of Electrical Inspectors; B. C. Hill, supervising inspector, city of Oakland, Cal., representing California Association Electrical Inspectors.

Trade Barriers Chief Topic at Stockholm

International Chamber of Commerce, Which Initiated Study of Trade Barriers, to Discuss Geneva Conclusions—Will Probably Approve Them

By Edward J. Mehren
Vice-president McGraw-Hill Publishing Company, Inc.

(By Cable)

REMOVAL of trade barriers looms as the dominant topic at the International Chamber of Commerce at Stockholm, Sweden, first because it is so important for Europe and, second, because the chamber itself initiated the study of this subject, which formed the basis of a large part of the work of the recent International Economic Conference in Geneva. The International Chamber of Commerce proposes to take up the Geneva conclusions. Its approval may be expected, because the decisions made at Geneva accord, in the main, with the chamber's own report. Backed by this official approval, the business men attending this meeting can go home and impress upon their responsible ministers the need of legislative action to remove economic barriers. Forty-one countries are represented and there are 852 delegates attending.

Acting president Sir Alan Anderson pointed out in his opening address that individual governments will not act unless business shows that removal of their own barriers will be best for the national interests. These barriers are not merely tariffs, they include adverse treatment of foreign corporations, obstructions to transportation, prohibition of exports or imports and currency instability. Other subjects for discussion include patents, transportation by water, railroad and air, arbitration of international commercial disputes, international movements of capital and enforcement of foreign judgments.

America Well Represented

America is well represented by one hundred and fifty delegates under the able chairmanship of Owen D. Young. Among the delegates are W. W. Freeman, vice-president Columbia Gas & Electric Company; Philip H. Gadsden, vice-president United Gas Improvement Company; L. K. Comstock, chairman L. K. Comstock & Company; Roy D. Chapin, chairman Hudson Motor Car Company; John N. Willys, president Willys-Overland Company; Windsor White, chairman of the board White Motor Company; Norman H. Davis, New York; Willis H. Booth, vice-president Guaranty Trust Company; John H. Fahey, past-president United States Chamber of Commerce; Julius Klein, director United States Bureau of Foreign and Domestic Commerce; Fred I. Kent, vice-president Bankers' Trust Company; Charles H. MacDowell, president Armour Fertilizer Works, and William C. Redfield of Redmond & Company. Special interest attaches to the German delegation. This is the largest of all, in spite of the fact that the Germans are attending for the first time. To help American delegates with definite business objectives in Europe, the United States Department of Commerce has commercial attachés and trade commissioners from London, Paris, Berlin, Brussels, Rome, Copenhagen, Warsaw, Helsingfors and Riga present at the conference.

California Commission Establishes Welder Rating

Owing to the rapid increase in the use of electric welders by the industrial world, the manufacturers of such equipment have found it difficult to establish name-plate ratings on which central-station companies could apply appropriate rates, and as a consequence of the lack of uniformity and reliability in these ratings confusion has accompanied all efforts to effect proper billing, according to a report of the Railroad Commission of the State of California. In an effort to overcome this difficulty the commission's gas and electric division has carried on an extended investigation of this problem and a solution has been arrived at. Direct-current welders presented no difficulties, and consideration of them was accordingly eliminated and all efforts centered on alternating-current equipment.

In the study of this problem a series

of tests were performed on all available types of alternating-current welders in the Bay region, and the conclusion was reached that a percentage of instantaneous maximum-kva. input was the most reliable rating. For this purpose the commission decided that each kva. of input will be considered as 1 hp. and the rating of a welder will be its tested input multiplied by a factor of 40 per cent for spot welders and 50 per cent for arc welders. Where name-plate ratings are known to be reasonably in line with such arbitrary ratings their use will be permitted. With the ratings thus established the commission feels that the application of the appropriate schedule will become a natural consequence.

Two of the major utilities—the Pacific Gas & Electric Company and the Western States Gas & Electric Company—operating in the central part of the state have accepted this plan, and its early adoption by all other utilities having to deal with similar types of service is expected. The commission hopes that the co-operation of the manufacturers of alternating-current welders may be enlisted and that ultimately a uniformity of ratings may be secured which wi'l do away with the further use of arbitrary methods.

Welding Electric Machinery

General Electric Company Utilizes Electric Arc Welding for Fabrication of Many Types of Machines—Rolled Steel Replaces Castings in Many Products

WHAT promises to be a revolutionary step in the manufacture of electric machinery is the adoption of electric arc welding for the fabrication of many types of machines by the General Electric Company. This practice results in many decided advantages

ARC WELDING IS NOT CONFINED TO ANY PARTICULAR PRODUCT

This is shown in this welded structural-steel top frame for 73,000-volt oil circuit breaker.

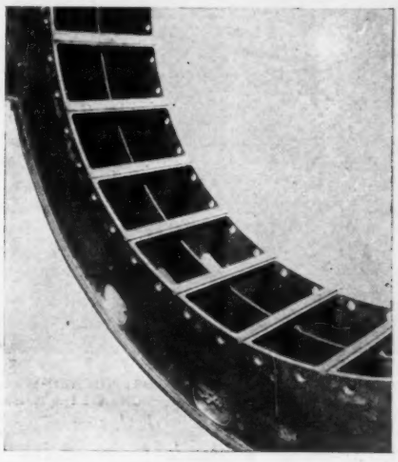
over the use of castings. Electric arc welding, which has recently attracted world-wide attention because of its possibilities in replacing rivets in the construction of buildings, was first tried out in the construction of electric machinery by the General Electric Company some years ago. The many advantages which attended the use of electric arc welding soon became so obvious that its field was rapidly widened until at the present time a very large percentage of General Electric machines are being constructed by the new method.

MANY APPLICATIONS MADE

Electric arc welding is used in the General Electric shops in making magnet frames and armature spiders for direct-current motors and generators and synchronous converters; stator frames and rotor spiders for alternating-current machines; bases, bearing pedestals, guards and air shields or deflectors for various types of machines, etc. In addition to these electric machines, transformer tanks, oil-circuit-breaker tanks, switch mechanisms and control devices, electric refrigerators, mercury boilers, centrifugal compressors and many other types of equipment are constructed to a greater or less extent by the use of electric arc welding.

When castings are used it is necessary to maintain pattern shops, pattern storage, core shops and ovens, and foundries, together with space and equipment for making castings ready for the machine shop. Defects arising after a casting has been poured, cooled and annealed result often in long delays in the completion of a given machine, and these delays are eliminated with the use of welding. Other disadvantages attendant upon the use of castings and eliminated by the use of welding include loss of metal in the casting process, use of excessively heavy parts for very light duty, high machining costs, etc. Electrically arc-welded machines and parts, in addition, have the further advantages that they have the same strength as castings but are considerably lighter in weight, designs are not restricted to existing patterns, less copper is needed to produce the same density of field flux in rotating machines, greater freedom in ventilation is provided, smaller revolving weights and diameters are allowed, etc.

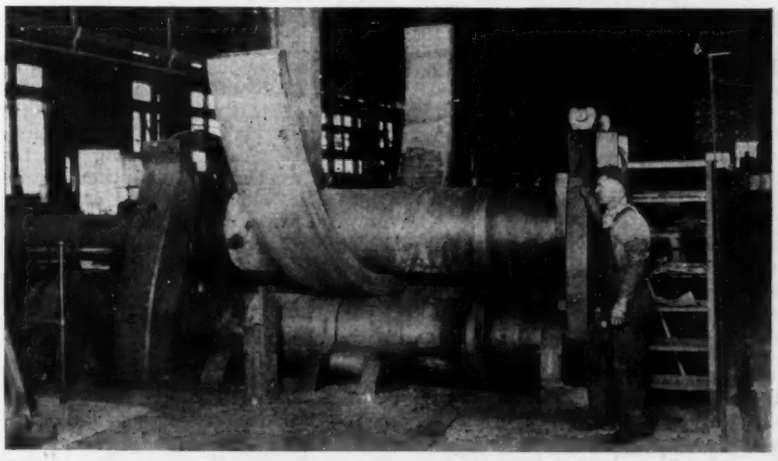
Rolled steel fabricated by welding has thus been used to a large extent in displacing castings in machine construction. Rolled steel is easily machined and presents but little variation in that characteristic; hence speeds and feeds for machining are uniformly high and yet the tools stand up well. The practice of premachining small parts and locating them by jigs in the fabrication process eliminates much of the heavy machine-tool work, and this saving, coupled with the decreased number of machined rejects in this stage of manufacture, reduces the shop overhead costs.



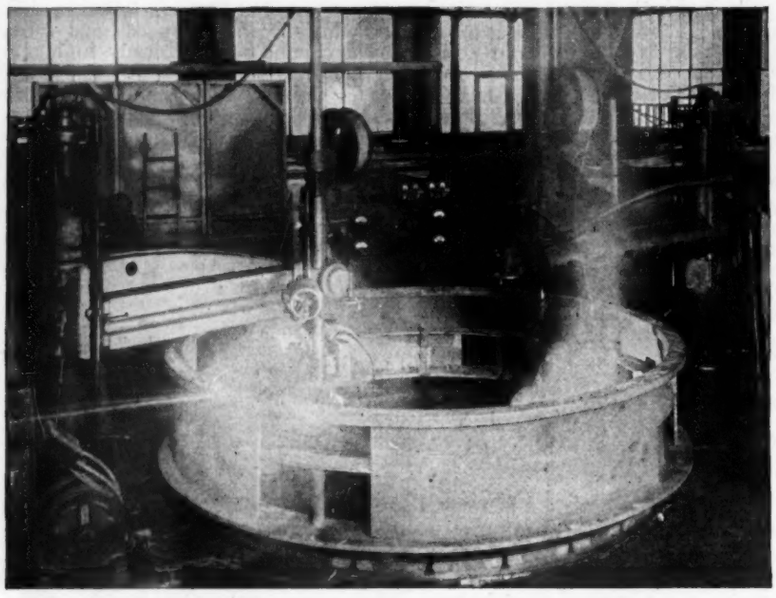
SECTION OF THE FABRICATED STATOR FRAME OF A 4,500-HP., 450-R.P.M., 2,200-VOLT MOTOR

Magnet frames of direct-current motors and generators and synchronous converters are now made by hot-rolling steel slabs to the desired radius. Where a split frame is not required, the frame is rolled from one piece and the ends are welded together. Split frames are rolled in semi-circles. Structural-steel slabs cut to shape are welded to the frame to form the feet, and premachined round bosses cut from billets and bolted together to assure their alignment are welded to the split frames to hold the halves together. A light machine cut gives a true inside diameter to which the pole pieces are fastened.

Bearing pedestals as large as those required for a 4,000-kw. unit have been fabricated from plates, a box form with heavy slab footings giving the necessary strength and rigidity. In



ROLLING A RED-HOT SLAB INTO SHAPE FOR USE IN THE FABRICATION OF A DIRECT-CURRENT MAGNET FRAME. FEET AND LUGS FOR BOLTING ARE WELDED TO THE FRAME



TWO-HEAD AUTOMATIC ARC-WELDING MACHINE IN OPERATION ON A 14-FT. STATOR FRAME

fact, whenever a standard structural shape of the required size or character is not available it can be fabricated with little trouble from plates or slabs at hand. With stator frames, rotor spiders, bases, bearing brackets and accessories of welded fabrications, not only has it been possible to build units of great capacity without castings, but it has been possible to build them without the aid of proportionally large machine tools.

In the case of large electrical units, each machine is usually built "to order" and has to be specially designed, to a large extent. When castings are used, this necessitates the preparation of special drawings, patterns and often pits in the foundry. Such work is much simplified when electric arc welding is used, because of the freedom with which standard slabs, plates, sheets and bars can be shaped and the speed and ease with which parts can be arc-welded together, including reinforcements and precision members. Work can be started on the construction of an arc-welded machine as soon as the drawings are made. Another advantage of the new method is the freedom from breaks in machine framework. When a casting is accidentally dropped or some other accident occurs, a foot may break off or a crack develop, and these rarely can be repaired. With machines fabricated by the welding method there is little possibility of breakage in rough handling, and any damage resulting therefrom can be more readily repaired.

The General Electric Company uses both hand and automatic welding in this work. The welding is, however, done largely by automatic machines which impart the desired motion to the electrode, which, in turn, is fed automatically from a reel to the arc, forming the weld at a rate of 6 in. per minute. Hand welding is done around fittings and on short seams in general.

Business Conditions

SALES in the electrical industry are in fair volume. Several good equipment orders reported from some sections of the country include hydro-electric apparatus, street-railway equipment, and substation material. Virtually all sections report active industrial buying. Although there is a seasonal quietness, electrical men are confident of improving business in the fall. Central-station supplies are in steady demand.

Increased activity in electrical equipment orders is noted in the New England district, particularly for hydro-electric apparatus. Street-lighting equipment is particularly active and a few steam-turbine inquiries are reported. June sales show a decrease in the New York district, although most manufacturers report that the volume of business for the first six months of this year is about the same as for the same period last year. In the Southeast business is quiet. A few large orders were closed, including one for $140,000 worth of substation equipment. The industrial field is active, with good prospects for future business. Good power apparatus sales, amounting to about $100,000, are reported in the St. Louis district, as well as $70,000 worth of electric street-car equipment. Little change is noted in conditions in the Middle West. Jobbers' sales are slow, but there is considerable municipal and railroad business being placed. On the Pacific Coast good industrial business is being placed, but power-company buying is quiet. The lumber mills are operating on a curtailed schedule.

Lead Market Active—Copper and Zinc Sales Quiet

Prices show little change in the nonferrous metal market. Lead was in excellent demand, particularly during the latter part of last week before successive price declines were cabled from London. Copper and zinc were in only moderate demand, and tin could hardly be called active.

NEW YORK METAL MARKET PRICES

	June 22, 1927 Cents per Pound	June 29, 1927 Cents per Pound
Copper electrolytic	12½	12½
Lead, Am. S. & R. price	6.40	6.40
Antimony	12½	12
Nickel, ingot	35	35
Zinc spots	6.525	6.55
Tin, Straits	67⅛	66⅛
Aluminum, 99 per cent	26	26

Base copper price June 29, 1927, 14⅛ cents.

June Sales Show Decrease in New York District

Sales to public utility companies in the New York district continue quiet, and inquiries are coming in slowly. Most manufacturers report that June has been a poor month, but that the volume of business for the first six months of this year is about the same as for the same period last year. In the industrial field the demand for motors is good and some manufacturers report an increasing volume of orders, particularly for medium-sized machines. Individual orders are mostly for small quantities, but the large total volume seems to indicate a healthy industrial condition. Control apparatus is in good demand, and June sales are generally reported to be in excess of those made in the previous month.

Equipment Orders Revive in New England District

Increased activity in electrical equipment orders featured trade in the New England district. The Southern New Hampshire Hydro-Electric Company is expending about $340,000 on hydro-electric generating plant improvements and transmission-line construction, including a 1,375-kva. vertical generator and waterwheel for Canaan, Vt., and a 40-mile line to connect with Lancaster, N. H. The Twin State Gas & Electric Company is expending about $138,000 in hydraulic betterments at Gorham, N. H. Industrial substation equipment is in demand for southern New Hampshire, and instrument transformer sales are displaying considerable activity. Fiber conduit is moving vigorously, three carload orders being placed last week for southern Massachusetts, and three carloads of cables were also sold by a prominent jobber. Poles, cross-arms and insulators are in good demand.

Wiring devices are a bit dull, motors are selling in about the same volume as last week, and meter sales are running far ahead of last year. Electric refrigerators are moving well in response to intensive sales work. A Salem apartment house has purchased sixteen units and another installation of thirteen has just been made in the

same city. A prominent operating syndicate sold 421 domestic electrical appliances last week, among which were 197 flatirons, 33 cookers, 25 portable lamps and 31 toasters. Street lighting is a market feature and there are a few steam turbine inquiries.

Business Quiet in Southeast—A Few Large Orders Noted

With the exception of a few large individual orders, there is little activity in the electrical field in the Southeast. One central-station company ordered power substation equipment amounting to approximately $140,000, while another power company order was for a carrier-current set costing $7,000. There is in more or less immediate prospect the purchase of a 15,000-kva. condenser with switching and auxiliary equipment, while another prospective order covers pole-line construction materials for a South Georgia job amounting to $35,000, and this latter order should materialize in the very near future. Small distribution transformers and house-type meters are in satisfactory demand, but no single orders of particular moment are reported. Central-station merchandising activities continue to sustain the volume of appliance sales and the movement of fans is reported particularly good.

In the industrial field there is a satisfactory activity, with prospects on future business excellent. A Georgia textile mill recently ordered transformers, motors and switchboard equipment amounting to $11,000, while another Georgia textile plant ordered 200 electric water heaters for installation in the houses in its mill village. An order received from an industrial contractor called for $11,000 worth of motion-picture switchboard and ventilating equipment.

Good Industrial Business Noted on Pacific Coast

Varied machinery orders placed on the Pacific Coast include three 200-kva. feeder regulators totaling $20,000, 500 ½-hp. motors valued at $8,000 for use in domestic water supply systems, motors and transformers amounting to $5,000 for a dredging company, switchboards totaling $18,000 for a Riverside cement works, a 2,500-kw. transformer, costing $7,000, for the Hawaiian Islands, two synchronous motors, totaling $7,000, for an ammonia refrigerating plant, three arc welding sets, costing about $1,200 each, for south San Francisco plants and 12 two-speed oil well motors. Oil company business of this nature continues surprisingly good. Lighting units amounting to $17,500 were ordered in San Jose. Bonds are now being offered to finance the Stanislaus irrigation project and it is expected that in about thirty days bids will be asked for the necessary equipment. Power company business is quiet, the outstanding supply order covering two carloads of guy wire. Contractors' orders are fair, but dealers' orders are rather poor, considering the June bride stimulus to sale. A 10 per cent advance in certain steel pole line specialties is reported.

An appropriation of $681,000 for extensions and betterments to the municipal lighting system has been passed by the City Council of Seattle, $330,000 will be expended on distribution lines within the city and the remainder will be used for enlarging the South substation and extending high-voltage feeder lines and the street lighting system. The town of Morton, near Tacoma, has approved a bond issue of $40,000 to build a power line from the Tacoma municipal plant and install a local distribution system, and the town of Centralia is taking bids for a ten-thousand-dollar street lighting installation. The Grays Harbor Railway & Light Company, Aberdeen, has completed plans for a 130-mile transmission line extending from the proposed hydro-electric development at Mossyrock and Mayfield on the Cowlitz River. The sale of approximately $20,000 worth of motors, ranging from 650 hp. down, for a cement plant in Snohomish County is reported. The city of Seattle has purchased 15,000 wood pins. Lumber mills in the Puget Sound section are now operating on a 25 per cent curtailment program and it is reported that many are preparing for a shutdown of from two weeks to a month.

Power Apparatus Sales Reported in St. Louis District

Power and transmission apparatus have been selling in good volume in the St. Louis district. The city of St. Louis opened bids for two 500-kva. turbo-generating units to cost about $40,000 and a switchboard for $16,000. Another order was placed for a 1,000-kva. turbo-generator for a power company in southeast Missouri at a cost of $35,000. An order for electric street-car equipment amounting to $70,000 for the southwestern part of this district is also reported. One of the oil-producing companies in northern Oklahoma has purchased transformers and motors for oil-well pumping at a total cost of $28,000. Manufacturers say that the demand for fractional-horsepower motors is steady and increasing in volume. Sales of appliances, with the exception of fans, have been several points above last year's record. The demand for building materials has been falling behind that for last year.

Little Change Noted in Conditions in Middle West

Little change in general business conditions is noted in the Middle West. Industrial activity is somewhat slow and with decreased production in the steel industry the outlook is not particularly promising. Some encouragement is derived from the high car loadings, but these were below last year's mark. The various utility companies are continuing a hand-to-mouth policy and maintenance purchases have declined sharply. Construction work has fallen off considerably, although necessary construction and extension of service are going on. Some purchasing of apparatus is being done, although capital investment is being restricted. Further reductions in labor are being effected. Among the interesting orders placed was one for 300 distribution transformers, 10 kva. to 37½ kva., another for pole-line hardware valued at $50,000, and another covering several carloads of busbar copper. Cable manufacturers report receiving several large inquiries for paper-insulated and lead-covered cables, but state that varnished-cambric business is particularly desirable at this time.

The jobber's business is for the most part slow. Considerable municipal and railroad business is being obtained, but the lack of industrial business is being felt keenly. Appliances of the gift type are moving quite readily, but the volume of business is not good. In the Chicago territory there have been virtually no sales of fans owing to the extremely cool weather. There was an announcement of a general increase in the price of cotton goods, although this has been expected for some time.

Activities of the Trade

Warren Telechron Company Holds Sales Meeting

Sales representatives of the Warren Telechron Company met last week at the Ashland (Mass.) factory in a two-day conference and expressed a favorable opinion as to the future business growth of the company. Sales Manager C. E. Davis presided, and during the meetings H. E. Warren, president, announced several new developments, including a new frequency recorder, improved automatic frequency-control apparatus and time stamp and tower clock design improvements. It was also announced that arrangements have been made with the Herschede Hall Clock Company, Cincinnati, for the production in connection with synchronous clock equipment of chime clocks and high-grade cases adapted to a broader field of marketing. Among the speakers at the conference were Walter Herschede, president of the Herschede company; E. J. Holland, A. E. Bergeron, W. B. Wells, J. W. Babb, A. J. Frank, L. E. Kingman of *House and Garden*, G. A. Karlson, I. W. Kokins, J. P. Hadcock, J. J. Ahearn, R. B. Sheffer and H. S. Knowlton, New England editor ELECTRICAL WORLD, who gave an address on the residential market for electric service.

New Type of High-Tension Switch Arouses Special Interest

A fuse-break switch embodying marked improvements over the usual type of air-break switch was one of the new developments exhibited by Schweitzer & Conrad, Inc., 4435 Ravenswood Avenue, Chicago, at the recent National Electric Light Association convention. When asked to express his views on the convention, N. J. Conrad, general manager of the company, said he was very well pleased with the great interest which was shown by the convention delegates in the exhibits in general and that it was indeed gratifying to see the interest aroused by this latest devel-

opment in switching methods. In this switch the S. &C. fuse is used for breaking the load, instead of breaking the arc in air or oil, by automatically shunting the fuse across the opening between the switch blade and contact clip at the instant when the switch blade has moved a sufficient distance away from the clip to prevent re-establishment of the arc.

The fuse-break switch is made for three-pole operation and each pole is provided with three fuses which are automatically shunted, one at a time, across the switch gap during each opening operation. The switch can, therefore, be opened three times under load before replacing the load-interrupting fuses. A complete description of this new switch will appear in an early issue of the ELECTRICAL WORLD.

Arrow Electric Company Offers Preferred Stock

The first public offering of securities in the form of an issue of $2,000,000 of 6½ per cent cumulative preferred stock of $100 par value has been offered through an Eastern banking syndicate by the Arrow Electric Company, Hartford, Conn. This company is a manufacturer of electric wiring devices and for more than 20 years virtually all of the common stock has been owned by the present management and associates, who will continue in active management and will also retain ownership of the common stock.

The stock is priced at $98.50 per share to yield about 6.60 per cent. An application will be made to list the preferred stock on the Hartford Stock Exchange.

Brown Boveri Issues Report

New Line of Endeavor Being Followed by Company—Laurence R. Wilder Resigns Presidency

IN THE annual report of the American Brown Boveri Electric Corporation, 165 Broadway, New York, for the year ended Dec. 31, 1926, William M. Flook, chairman of the executive committee, says to the stockholders that "a reduction of the scope of the company's immediate business and activities to lines of endeavor within its present powers, with promise of immediate profit, is actively under way." It is further stated that it has been recognized by the management and the board of directors that the continued prosecution by the company of its program of immediate intensive development of the electrical business at Camden, N. J., will make demands which its existing financial resources do not justify. The resignation of Laurence R. Wilder as president of the corporation was also announced. Mr. Wilder will become chairman of the advisory committee of the shipbuilding division of the corporation.

During the year 1926 the report states that substantial expenditures were made in the development of the electrical business at Camden, both in plant construction and adaptation and in the engineering, organization, advertising, sales promotion, patent and general development, etc. During this period practically no deliveries of electrical equipment were made. However, orders aggregating nearly $4,000,000 were procured for delivery during the years 1927 and 1928. The subsidiary companies as a whole were operated successfully during the year. They showed an earned profit of $1,236,492.52. However, to enable the subsidiary companies to cope with the increased volume of business the parent corporation found it necessary to increase its cash investment in their securities in order to furnish them with additional working capital. The value of the company's land at Camden has been appreciated after an exhaustive survey, and it is shown as a surplus credit in the consolidated income and surplus account which appears in the accompanying table.

CONSOLIDATED INCOME AND SURPLUS ACCOUNT AMERICAN BROWN BOVERI ELECTRIC CORPORATION AND SUBSIDIARY COMPANIES
Year Ended Dec. 31, 1926

Net income from operations (after deduction of $665,175.65 of expenditures of electrical division at Camden, N. J., as set forth in note below)			$671,352.30
Other income:			
Interest, dividends, discount, etc.			224,672.08
			896,024.38
Other deductions:			
Bond interest, discount, etc.			586,306.89
			309,717.49
Deduct: Dividends on preferred stock of subsidiary companies in hands of public			78,677.25
Consolidated net profit applicable to parent company			231,040.24
Consolidated surplus Dec. 31, 1925 (including surplus from appreciation of property and capital surplus)		$2,256,226.01	
Add: Adjustments—net		121,575.04	2,377,801.05
			2,608,841.29
Surplus credits:			
Appreciation of land at Camden, N. J.		4,500,000.00	
Inventory adjustment		481,672.29	
Discount on repurchased bonds		5,019.14	4,986,691.43
			7,595,532.72
Surplus charges:			
Dividends—cash:			
On preferred stock	$210,000.00		
On participating stock	790,512.00	1,000,512.00	
Dividend—stock (by subsidiary company)		777,510.82	
Provision of reserve for contingencies		3,500,000.00	
Expenditures of electrical division at Camden, N. J., as set forth in note below		536,492.13	
Sundry charges		126,909.80	5,941,424.75
Consolidated surplus—Dec. 31, 1926 (including surplus from appreciation of property and capital surplus)			$1,654,107.97

Note.—On resolutions of the Board of Directors passed subsequently to Dec. 31, 1926, expenditures amounting to $1,734,321.67 representing reorganization fees and expense, and expenditures deemed by the company to have been made for the development of the electrical division at Camden, N. J., have been (a) capitalized as deferred charges to the amount of $532,653.89, (b) charged to "surplus from appreciation of land" to the amount of $536,492.13 and (c) charged as expenses of 1926 to the amount of $665,175.65.

Bryant Electric Company Elects New President

W. C. Bryant, who for thirty years has been the executive officer in charge of the Bryant Electric Company, Bridgeport, Conn., manufacturer of wiring devices, has resigned as president, and has been elected chairman of the board of directors. Mr. Bryant will retain an active interest in the affairs of the company. Walter Cary, first vice-president of the Westinghouse Lamp Company, has been elected president in direct charge of the operation of the business. The company announces that the same general policies which have governed the conduct of the business in the past will be continued.

Driver-Harris Company Offers First Mortgage 6 per Cent Bonds

To retire an issue of first mortgage 8 per cent bonds, to provide additional working capital and for other corporate purposes, the Driver-Harris Company, Harrison, N. J., has offered an issue of $1,300,000 first mortgage sinking-fund fifteen-year 6 per cent gold bonds at $98 and interest to yield 6.20 per cent. The offering was made by Hambleton & Company and John Nickerson & Company of New York. The company, which was organized in 1899, manufactures nickel-chrome alloyed wire and castings, special metal alloys and pure metals. In 1925 the company acquired the business and property of the Electrical Alloy Company of Morristown, N. J., which is now operated as a division of the Driver-Harris Company. For the year ended Dec. 31, 1926, the income available for bond interest, after depreciation but before federal tax deduction, amounted to $494,679.

General Chromium Corporation Controls Chromium Patents

The General Chromium Corporation, 3220 Bellevue Avenue, Detroit, has been formed for the purpose of consolidating certain basic patents, research laboratories, engineering knowledge and facilities for the process of chromium plating, known as "Duro-Chrome." Under this management a plan is now in operation in Detroit where complete engineering service, job plating and licensing rights may be obtained on a commercial basis.

Among the patents and patent applications controlled by the corporation are those owned by the Electro Metallurgical Company, which patents and

patent applications are said to be the results of several years of intensive experimentation on chromium plating by the Union Carbide & Carbon Research Laboratories, Inc. The corporation states that all of the advantages accruing from these combined resources and chromium plating processes are now available to manufacturers throughout the world. The directors of the corporation are Fred J. Fisher, General Motors Corporation; F. M. Becket, Union Carbide & Carbon Research Laboratories, Inc.; Benjamin O'Shea, Union Carbide & Carbon Corporation; A. E. Baldwin and Horace Maynard, General Chromium Corporation, and C. Roy Gleason and Burton O. Smith, Vacuum Can Company.

Anaconda Copper Mining Buys Detroit Copper & Brass

The Anaconda Copper Mining Company, through a subsidiary, has acquired the assets and business of the Detroit Copper & Brass Rolling Mills and that plant will hereafter be operated by the American Brass Company as its Detroit branch. It will be the policy of the American Brass Company to operate this plant along the lines followed in the past. The Detroit Copper & Brass Rolling Mills has a capacity of 100,000,000 lb. annually of finished products and its production is now said to be around 75,000,000 lb. per year.

Electric Hoist Manufacturers Report on Sales at Annual Meeting

At the annual meeting of the Electric Hoist Manufacturers Association it was reported that domestic business for 1926 in the distribution of electric hoists was virtually the same as for 1925, both in the number and value of units, although there was a definite gain in export distribution. During the year 1926 a change was made by the association in the method of reporting statistics so that the quantities are now segregated under standard rating sizes instead of in bulk, giving a better line on the trend of the business in the different hoist capacities. At the meeting a comparative report was also presented showing the number of hoists sold during the years 1922, 1923, 1924, 1925 and 1926, classified according to the various lines of industries.

The General Electric Company through the General Electric Employees Securities Corporation has paid interest amounting to $1,076,181 to holders of its bonds. These bonds bear 6 per cent coupons but as long as the original holders remain in the employ of the General Electric Company an additional 2 per cent is paid.

The Robbins & Myers Company, Springfield, Ohio, reports for the quarter ended March 31, 1927, an operating loss of $141,651 after deduction for depreciation, interest and other charges. The net sales of the company during that period totaled $812,532.

The Tubular Woven Fabric Company, Pawtucket, R. I. announces that it has discontinued its arrangement with Allied Industries, Inc., as its Pacific Coast representative and has appointed C. Dent Slaughter as representative for the entire "Durabilt" products line on the West Coast. Mr. Slaughter will have offices and warehouses in the principal West Coast jobbing cities.

The American Neon Light & Sign Corporation has been recently organized in New York City, according to an announcement by Otto B. Shulhoff, former Commissioner of the Port of New York Authority, for the manufacture of neon beacon lights for airplanes.

The Hevi Duty Electric Company, Milwaukee, manufacturer of electric heat-treating furnaces, has appointed the Beeman Equipment Company, 458 Twenty-first Street, Detroit, as a sales representative. The company also announces the appointment of the R. D. Thomas Company, 521 Arch Street, Philadelphia, as sales representative in the Philadelphia territory, comprising the eastern half of Pennsylvania, the southern half of New Jersey, the States of Delaware and Maryland and the District of Columbia.

The Kent Company, Inc., Rome, N. Y., manufacturer of waxing, polishing and scrubbing machines, announces the appointment of William L. Schoonmaker as sales manager. Mr. Schoonmaker formerly had charge of the export sales of all motor-driven household appliances of the International General Electric Company.

The Galvanized Products Company, East Stroudsburg, Pa., a subsidiary of the Line Material Company, South Milwaukee, Wis., has work under way on a new one-story addition, 40 ft. x 82 ft., to be used primarily for forge service. Plans are being perfected to concentrate production of substation equipment, switches and fuses at the local plant in the future. Heretofore street-lighting apparatus and similar products have been manufactured at East Stroudsburg, but will be handled by the parent organization at another works.

The Tung-Sol Lamp Works, Inc., 95 Eighth Avenue, Newark, N. J., has acquired property at High Street and Seventh Avenue and will use at an early date for plant expansion.

New Equipment Available

Audible Smoke Detector

The Rich audible smoke detector, designed to protect all types of rotary machines and automatic substations from fire, has been developed by Walter Kidde & Company, 140 Cedar Street, New York City. The operation of the detector is based upon the principles of reflected light and television. The company states that extreme sensitivity has been attained in this new device, that the smoke emitted from an ordinary safety match is more than sufficient to operate the alarm, and even in invisible quantities it is magnified by the Rich principle and its presence is recorded. Owing to the sensitivity of the detector, any smoke distilling from the insulation of the windings of a generator, because of overheating, is detected before the rupture and resulting fire actually occur. In addition to operating the alarm, this smoke can be made to automatically stop the generator turbine and release the Lux inert gas extinguishing system used in connection with the device.

More than one generator can be protected by a single detector by installing a collecting device. Pipe lines are run from the ventilating system of each machine protected to the collector which sends air samples alternately from each pipe to the detector. The detector is also intended for use in automatic substations for protection against fire in oil switches or induction regulators. The alarm can be connected with the central station independently, or through the supervisory system of the substation. The protection afforded is not limited to one room in a substation, but a collector may be installed, as in case of generators. The pipes are run from the collector to each compartment of the substation, terminating in smoke accumulators located centrally on the ceiling of each space. The collector sends air samples alternately from each room to the detector. When combined with a Lux extinguishing system direction valves controlled by the detector can be fitted to discharge the gas into the compartment which is afire. The device is entirely self-supervisory, and the manufacturer claims it affords thorough and positive fire protection. The company states that the initial installation for generator protection will be undertaken shortly at the Fisk Street Station of the Commonwealth Edison Company, Chicago.

Open-Type Knife Switch

A 300-amp. open-type knife switch for vertical or horizontal mounting and made for either 7,500-volt or 11,000-volt maximum service, has been placed on the market by the W. N. Matthews Corporation, St. Louis. The company states that this switch has large positive contacts and that the locking device is so designed that a downward pull unlocks and opens the switch.

Small Dust-Tight Compensator.—A small automatic compensator whose operation will not be affected by the dust prevalent in grain elevators, coal-crushing plants and other similar places has been placed on the market by the General Electric Company. This compensator is known as the CR-7051-J-2 and is inclosed in a boilerplate case. A standard automatic compensator is used in the construction, but the usual conduit box, wall support and top and front covers are omitted. The case is made up as a unit with angles on which the compensator may be slid in or out. When the compensator is in position the angles can be raised, thus allowing the front door to close.

New Trade Literature

PULVERIZED-FUEL EQUIPMENT.—A booklet describing the "Pulverburner," a complete mechanism of the unit type for firing powdered coal, has been issued by the Illinois Stoker Company, Alton, Ill. Attention is called to the consolidation of the K-B Pulverizer Corporation and the Illinois Stoker Company which has made it possible to offer the complete unit-type mechanism. Eight proved advantages of the "Pulverburner" are outlined, and the operation and construction are described and illustrated. Some typical "Pulverburner" service records accompanied by charts are included. A table gives the fineness of coal and velocity of air in pipes and burner nozzle.

GUN FOR SPRAYING REFRACTORY PRODUCTS.—The Botfield Refractories Company, Swanson and Clymer Streets, Philadelphia, is distributing a booklet entitled "For a Long Furnace Run Use the Adamant Gun." This booklet describes the "Adamant" gun for use in facing or coating the fire-exposed surfaces of new or old furnace linings with "Adamant" firebrick cement, pre-mixed with "Adachrome" or other refractory materials.

DIE STEEL.—A booklet entitled "H.Y. C.C. the Efficiency Steel" has been issued by the Crucible Steel Company of America, 17 East Forty-second Street, New York. The booklet illustrates and describes the application of this steel in making dies, cutters, punches, etc. Illustrations show dies which have been used in punching silicon steel laminations after having been in use for a considerable period.

SPEED REDUCERS.—The H. W. Caldwell & Son Company, Chicago, has issued booklet No. 630, covering the Caldwell Speed Reducers, types "A" and "B." Type "A" is designed for conveyor, elevator and general industrial service and type "B" for driving screw conveyors. Diagrams showing typical drives and dimension tables of both types are included.

GENERAL-PURPOSE MOTORS.—The Crocker-Wheeler Electric Manufacturing Company, Ampere, N. J., has issued bulletins Nos. 222, 223 and 225, describing its new line of ball-bearing general-purpose motors, forms "P," "H" and "F," for alternating current and direct current. A number of illustrations showing the complete construction of the different types are included.

ELECTRIC FURNACE.—The Ajax Electrothermic Corporation, Ajax Park, Trenton, N. J., is distributing a circular entitled "250 Lb. of Steel Every 20 Minutes," in which it describes and illustrates the Ajax-Northrup electric furnaces for large scale production. The bulletin contains the log of a typical melt made on "nichrome."

COMPENSATOR, CONTROL AND SWITCHING EQUIPMENT.—The General Electric Company, Schenectady, N. Y., is distributing bulletins GEA-140, GEA-416A, GEA-250, GEA-530A and GEA-429, covering its CR1034-K1 hand-starting compensators, CR7051 automatic starting compensators, CR3204 drum-type control equipment, type MT control equipment and automatic switching equipment respectively.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

Purchase and agency are desired in Copenhagen, Denmark (No. 26,067), for advertising signs and for household electrical heating and cooking equipment.

An agency is desired in Adelaide, Australia (No. 26,024), for dish-washing machines.

An agency is desired in London, England (No. 26,021), for electrical household appliances.

An agency is desired in Bucharest, Roumania (No. 26,100), for household electrical appliances.

Purchase and agency are desired in Ottawa, Canada (No. 26,102), for household electrical appliances and for electric wiring materials.

An agency is desired in Sydney, Australia (No. 26,023), for household electrical appliances, especially clothes driers and floor polishers; also electric hand lamps for miners (26,022), and for power generating and transmission machinery (26,039).

An agency is desired in Bilbao, Spain (No. 26,076), for lighting sets and accessories for railway cars.

Purchase is desired in Cologne, Germany (No. 26,101), of electric household refrigerators, 50 to 100.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

BOSTON, MASS.—Bids are being asked (closing date not announced) by the Supply Office, Navy Yard, Boston, for one switchboard panel complete (Req. N. S. A. 887).

SPRINGFIELD, MASS.—The Board of Water Commissioners has engaged Charles T. Main, 201 Devonshire Street, Boston, consulting engineer, to make investigations and prepare estimates of cost for a proposed municipal hydro-electric plant on the Little River, in connection with a proposed water supply system from that source.

Middle Atlantic States

ALBANY, N. Y.—Bids, it is understood, will soon be asked by the Department of Health, Capitol, for construction of west wing of laboratory, power house and stable units for the Department of Health. S. W. Jones, Capitol, is state architect.

GREAT NECK, N. Y.—The installation of an improved lighting system on Middle Neck Road is under consideration. The plans call for sixty-three lamps of 600 cp. mounted on ornamental brackets, to be maintained by underground wires.

NEW YORK, N. Y.—Bids will be received by C. S. White, purchasing agent, New York Central Railroad Company, Room 344, 466 Lexington Avenue, until July 7, for one motor generator set, starter, direct-current switchboard and transformers for substation service (Serial Contract No. 22-1927).

RAYBROOK, N. Y.—Bids, it is understood, will soon be asked by the Division of Standards, Executive Department, Capitol, Albany, for construction of power house at the Raymond State Hospital for Treatment of Incipient Pulmonary Tuberculosis. S. W. Jones, Capitol, is state architect.

JERSEY CITY, N. J.—The Public Service Electric & Gas Company, Newark, plans to build a substation at Sip and Whitman Avenues.

PHILADELPHIA, PA.—Bids will be received by the Pennsylvania Railroad, until July 8, for substation construction (Contract No. 84-1927). C. E. Walsh, 15 North Thirty-second Street, is purchasing agent.

WEST UNION, W. VA.—The Mountain State Utilities Company, which has acquired the local electric system, plans to build a steam-operated electric plant, to cost about $35,000.

BEDFORD, VA.—Arrangements have been made by the Town Council and the Appalachian Power Company, Bluefield, whereby the latter will furnish standby service here. The company will build a 1,500-hp. substation at Centerville, to cost about $35,000. The town will remodel the present substation and erect a transmission line to connect with the substation at Centerville.

RICHMOND, VA.—The Department of Public Works plans to install a flood lighting system, with light beacons, etc., at a proposed municipal airport, for which a site has been secured.

North Central States

HAMILTON, OHIO.—The Board of Control has authorized Guy Mitchell, service director, to award to the Westinghouse Electric & Manufacturing Company a contract for equipment in connection with the enlarging and rebuilding of the municipal electric light plant. In addition a new building will be required. The cost of the equipment is estimated at $287,700. The total cost will be about $525,000.

YOUNGSTOWN, OHIO.—Plans are under way by the Youngstown Sheet & Tube Company to equip its plant at Campbell for electrical operation within the next year. The cost is estimated at $6,000,000.

BEARDSTOWN, ILL.—Plans are being considered by the Central Illinois Public Service Company, Springfield, for the construction of a new electric plant here.

DANBURY, WIS.—Application has been filed with the Railway Commission by G. H., C. H. Kohler and E. L. Peet of Minneapolis for permission to build a hydro-electric plant on the Clam River, near Danbury, to develop about 500 hp. It is planned to supply electricity in Fallon, Trade River, Grantsburg, Siren, Danbury, Webster and other towns.

DULUTH, MINN.—The Duluth Street Railway Company has applied to the City Council for permission to place its power lines on West Third Street underground. The cost is estimated at $15,000.

FAYETTE, MO.—Plans have been prepared for the construction of a power plant at Central Howard Payne College, to cost about $100,000. Trueblood & Graf, Chemical Building, St. Louis, are architects.

KANSAS CITY, MO.—Plans for the proposed local shipyard to be erected by the Woods Brothers Corporation, Lincoln, Neb., on the Missouri River, at a cost of $250,000, include a power substation.

ST. LOUIS, MO.—Bids will soon be asked by the Grand Boulevard Improvement Association for the installation of a street-lighting system on that thoroughfare, between Easton and Laclede Avenues, to cost about $56,450. The plans call for 112 press steel standards.

KENMARE, N. D.—The City Council has granted a franchise to M. H. Erickson, Rugby, for the construction of an electric plant, and installation of local distribution system. A company will be organized to carry out the project.

NORTH PLATTE, NEB.—Bids will be received at the office of the Bureau of Reclamation, Mitchell, until July 26 for the installation of the second unit of the Guernsey power plant, North Platte project, Nebraska-Wyoming, including one 3,000-kva., vertical hydro-electric unit, together with inlet valve, switchboard, transformers, switching equipment, etc. The project does not cover the purchase of materials, which are to be furnished by the government.

ARKANSAS CITY, KAN.—Plans are under way by the Kansas Gas & Electric Company, Wichita, for the erection of a new transmission line to Arkansas City to furnish service to the north part of the city. The cost is estimated at $12,000.

HUTCHINSON, KAN.—Plans have been approved by the United Power & Light Company, Abilene, for an addition to its local steam-operated electric power plant, to cost about $35,000.

Southern States

AUGUSTA, GA.—Arrangements are being made by the Kentucky Power Company to erect a 33,000-volt transmission line (wood pole) from Flemingsburg to Morehead, a distance of 26 miles. The company also plans to erect a 33,000-volt line (wood pole) from Butler to Glencoe, 38 miles long.

SPRINGFIELD, TENN.—The Davidson Light & Power Company plans to extend its transmission line from Camden to several towns in Benton County, at a cost of about $25,000.

GOODMAN, MISS.—The Mississippi Power & Light Company, Pine Bluff, Ark., which recently acquired the local electric plant, plans to rebuild the electric plant and distribution system. A 200-hp. plant will be installed which will supply electricity in Pickens as well as in Goodman.

WEST POINT, MISS.—The Mississippi Power & Light Company, Jackson, which is negotiating for the purchase of the municipal electric plant is planning extensions in its transmission lines in this vicinity.

BASTROP, LA.—Plans for the proposed local paper bag manufacturing plant, to be built by a new company headed by J. R. Collen, head of the Southern International Paper Company, Bastrop, and associates, to cost about $700,000, include an electric substation.

CARVILLE, LA.—Bids will be received by the supervising architect, Treasury Department, Washington, D. C., until July 15, for the installation of an automatic telephone system in the local National Home for Lepers.

LAWTON, OKLA. — A committee has been appointed to negotiate with the Southwestern Light & Power Company relative to the installation of an ornamental lighting system in the business district.

EASTLAND, TEX.—The Oil Belt Power Company, a subsidiary of the Southwestern Power & Light Company, plans to erect 265 miles of transmission lines to radiate from its plant near Eastland, in which an additional 15,000-kw. turbine with auxiliary equipment will be installed.

NACOGDOCHES, TEX. — The Texas Power & Light Company, which has acquired the municipal electric plant, plans to rebuild the distribution system and erect a high-tension line from its central generating station at Trinidad to Nacogdoches.

Pacific and Mountain States

SPOKANE, WASH. — The construction program of the Washington Water Power Company calls for an expenditure of about $4,500,000. The work includes the completion of a generating unit at the Chelan hydro-electric development and improvements at the seven power stations and in the transmission and distribution system of the company.

COMPTON, CAL.—The City Council has authorized plans for the installation of an ornamental lighting system on the Long Beach Boulevard, for a distance of about 2 miles, using concrete standards. Glen Rood is city engineer.

EL CENTRO, CAL.—Plans have been approved by the Imperial Irrigation District for the construction of five hydro-electric plants on its canal system, to cost about $1,600,000. A transmission line will be built. M. J. Dowd is chief engineer.

PLACERVILLE, CAL.—Application has been made by A. G. Fraser, Placerville, and associates, to the Federal Power Commission for a permit to build a hydro-electric plant on Whaler Creek, to cost about $35,000.

SAN FRANCISCO, CAL.—A proposal to place all wiring underground on a portion of Guerrero Street and several other streets in the Mission district is under consideration by the lighting committee.

SAN FRANCISCO, CAL. — The Pacific Gas & Electric Company has applied to the Federal Power Commission for permission to develop the Bean Creek power site on the Stanislaus River, where it is estimated that 300,000 hp. can be developed. The plant will consist of four units, to cost about $43,000,000. The first unit will cost $13,000,000. The project includes the erection of a transmission line from the generating stations to San Francisco, 140 miles long.

TUCSON, ARIZ.—Bids will be received by the Construction Division, Veterans' Bureau, Washington, D. C., until Aug. 11, for electrical work, electric distributing system, electric elevators, refrigerating plant, etc. for the local Veterans Hospital.

MILES CITY, MONT.—The Minnesota Northern Power Company, Minneapolis, has applied for a franchise to build a steam-driven electric plant in Miles City. C. M. Garland Company, 38 South Dearborn Street, Chicago, is consulting engineer.

CASPER, WYO.—Plans have been completed by the Mountain States Power Company, Tacoma, Wash., for the purchase of a block of hydro-electric power from the government hydro and irrigation project at Guernsey on the North Platte River, connection to be made with the Casper division of the company's transmission system at Parkerton. This will require the erection of a transmission line 85 miles long.

CHEYENNE, WYO. — A contract has been awarded to the Cheyenne Light & Fuel Company for the illumination of the branch air mail route between Cheyenne and Pueblo, at $23,923. The equipment includes signal towers, beacons and tower structural material.

THERMOPOLIS, WYO.—A permit has been granted to Arthur K. Lee and Ray Phebus of Thermopolis to erect a high-tension line from the government hydro-electric plant at Shoshone dam to the Hamilton dome and Oregon basin oil fields.

COLORADO SPRINGS, COLO.—The City Council contemplates the installation of an airport lighting system, to cost about $15,000. F. O. Ray is engineer.

WELDONA, COL. — The Public Service Company of Colorado, Denver, has submitted a proposal to the citizens of the Weldon Valley offering to extend its service through the valley.

Electrical Patents

Announced by U. S. Patent Office

(Issued June 14, 1927)

16,658 (reissue). CONTROL MECHANISM; E. B. Thurston, Toledo, Ohio. App. filed March 3, 1927. Elevator controller for an alternating-current drive.

1,631,955. TRANSFORMER; C. Bergman, Bergenfield, N. J. App. filed April 12, 1924. Miniature type for energizing small appliances.

1,631,977. ELECTRIC MOTOR; F. W. Merrill, Fort Wayne, Ind. App. filed April 11, 1921. Small motor that may be shifted during full operation from one source of current to another without decreasing its speed or mechanical output.

1,631,987. ATTACHMENT FOR ELECTRIC CURRENT DEMAND METERS; W. H. Sommer, Peoria, Ill. App. filed Aug. 10, 1921. Alarm adapted to warn the operator when the demand reaches a predetermined point.

1,631,994. ELECTRICAL CONNECTION; A. A. Warner, New Britain, Conn. App. filed Feb. 1, 1923. Hinged connections for electrically connecting conductors carried by an operating handle with conductors carried by the member to which the handle is hinged, without requiring the use of flexible conductors.

1,631,995. PLURAL PLUG; C. E. Warner, Berwyn, Ill. App. filed June 29, 1922.

1,631,997. ELECTRIC FIXTURE SUPPORT AND CONNECTER; R. B. Benjamin, Chicago, Ill. App. filed March 5, 1923.

1,632,034. ELECTRICAL HEATING DEVICE; R. M. Moffit, Maumee, Ohio. App. filed Dec. 10, 1925. For heating a room by convection currents.

1,632,050. PROTECTIVE DEVICE; G. P. Wennemer, New York, N. Y. App. filed Nov. 21, 1923. A relay operated by the voltage developed by a thermocouple having a heater element of low resistance in series with the heater element of the thermocouple to be protected for use in connection with current-measuring instruments.

1,632,057. SIGNALING SYSTEM; L. E. Coon, Chatham, N. J. App. filed March 22, 1924. Selectively operated intercall systems.

1,632,059. ALARM SYSTEM; A. M. Curtis, East Orange, N. J. App. filed Aug. 16, 1922. Burglar-alarm system.

1,632,062. REGULATOR; J. G. Ferguson, Brooklyn, N. Y. App. filed Aug. 9, 1923. As applied to the regulation of a tuning fork or an electric motor.

1,632,076. METHOD OF DETERMINING INEQUALITIES IN WALL THICKNESS OF TUBES; F. A. Hubbard, Wyoming, N. J. App. filed April 22, 1925. A method of determining the variations in thickness of the sheath of lead-covered cable.

1,632,096. INSULATING WASHER FOR BRUSH-HOLDER BRACKET ARMS; R. H. Newton, Wilkinsburg, Pa. App. filed Sept. 26, 1925.

1,632,097. TRANSFORMER WINDING; J. F. Peters, Edgewood Park, Pa. App. filed June 7, 1926. Especially designed for the operation of tap changing.

1,632,105. MAGNETIC MATERIAL AND METHOD OF PRODUCING IT; L. Zickrick, Chicago, Ill. App. filed March 25, 1925. Brittle material which may be readily reduced to a finely divided form.

1,632,112. CONNECTOR MEMBER; C. Bramming, Chicago, Ill. App. filed Aug. 12, 1925. Terminal connector for attaching to a flexible conductor without the aid of screws, solder or the like.

1,632,120. DEMAND METER; D. C. Davis, Chester, Pa. App. filed Dec. 2, 1922.

1,632,126. ELECTRIC FURNACE; L. H. Giddings, Pasadena, Cal. App. filed March 15, 1926. For cremating purposes.

1,632,131. SEARCHLIGHT; T. Hall, Brooklyn, N. Y. App. filed Aug. 23, 1919. Portable.

1,632,136. METHOD OF MEASURING MAXIMUM CURRENT; I. Ikeda, Sendai, Japan. App. filed Dec. 30, 1924.

1,632,161. ARC LAMP; P. R. Bassett, Brooklyn, N. Y. App. filed July 24, 1923.

1,632,174. ELECTRIC SOCKET SWITCH; W. F. Conklin, Tarentum, Pa. App. filed Sept. 20, 1921.

1,632,225. ELECTRIC ELEVATOR SYSTEM; G. B. Grosvenor, Chicago, Ill. App. filed May 23, 1922. Automatic control of the slowing down and stopping of high-speed elevators.

1,632,298. SIGNALING TRANSMITTER; E. E. Kleinschmidt, Brooklyn, N. Y. App. filed Dec. 22, 1920.

1,632,307. PEROXIDE OF LEAD, ZINC AND SULPHURIC-ACID ACCUMULATORS; A. Miolati, Padova, Italy. App. filed April 22, 1924.

1,632,318. ELECTRIC HEATING UNIT; F. C. Simms, East Palestine, Ohio. App. filed May 29, 1925. For resistance furnaces.

1,632,358. TERMINAL FOR RHEOSTATS; G. H. Whittingham, Baltimore, Md. App. filed June 18, 1925.

1,632,364. BATTERY CELL; C. C. Carpenter, Niagara Falls, N. Y. App. filed Oct. 23, 1920. With special ventilation for marine service.

1,632,411. WELDING TOOL; R. Mattice, Bethelehem, Pa. App. filed July 7, 1925. For electric arc welding.

1,632,445. TOY ELECTRIC RANGE; R. Koenig, Two Rivers, Wis. App. filed Oct. 30, 1926.

1,632,510. ATTACHING BRACKET FOR LIGHTING FIXTURES; R. W. Schweiker, Lansdale, Pa. App. filed March 11, 1925.

1,632,534. SWITCHING AND STARTER APPARATUS OF ELECTRIC MOTORS; H. O. Bree, Auckland, New Zealand. App. filed Aug. 28, 1926.

1,632,535. BATTERY AND CONNECTOR; S. G. Breeden and P. L. Breeden, Memphis, Tenn. App. filed Aug. 2, 1926.

1,632,546. WELDING ROD; J. B. Green, Chicago, Ill. App. filed Sept. 20, 1926. Of ferrous metal containing carbide, the major portion of which carbide is in globular form.

1,632,567. SPEED AND COURSE INDICATOR FOR CONVEYANCES; F. G. Simpson, Seattle, Wash. App. filed Nov. 28, 1923. Apparatus for measuring the velocity, and indicating the direction of motion, of a terrestrial body relative to the surface of the earth.

1,632,573. PROTECTIVE SYSTEM; R. Willheim, Vienna, Austria. App. filed Aug. 31, 1925. For a plurality of parallel lines.

1,632,578. ARC LAMP OF THE SEALED TYPE; F. Bahr, Charlottenburg, Germany. App. filed Feb. 21, 1924.

1,632,599. SNAP PLUG; G. A. Hayward, Watertown, Conn. App. filed Oct. 6, 1925.

1,632,601. INDUCTION MOTOR; H. M. Hobart, Schenectady, N. Y. App. filed Oct. 4, 1924. Double-squirrel-cage winding.

1,632,609. ELECTRICAL INSTRUMENT; T. L. Lee, Rochester, N. Y. App. filed April 4, 1925. In which the effect of temperature upon the windings is compensated for.

1,632,622. CONTROL SYSTEM; D. C. Prince, Schenectady, N. Y. App. filed May 27, 1925. Wherein electron discharge devices are utilized in a manner to open and close a circuit without producing undesirable fluctuations in its electrical conditions.

1,632,623. ELECTRIC MEASURING INSTRUMENT; T. A. Rich, East Lynn, Mass. App. filed Oct. 19, 1926. Of the magnetic vane type.

1,632,627. SPEED-CONTROL SYSTEM; L. Schombourger, Paris, France. App. filed Jan. 24, 1925. Means for causing the motor to operate with compound characteristics and for improving its power factor.

1,632,628. DYNAMO-ELECTRIC MACHINE; H. K. Schrage, Paris, France. App. filed June 11, 1925. Compound-wound machine of the universal type having load and shunt excitation brushes which are independently adjustable with respect to the commutator whereby the no-load characteristics of the machine may be adjusted by means of the brushes associated with the shunt field and the load characteristics may be adjusted by varying the position of the load brushes.

1,632,647. INCANDESCENT LAMP; G. R. Fonda, Schenectady, N. Y. App. filed Jan. 24, 1925. Having the resistance to disintegration increased under operating conditions, and the mechanical strength of the filament improved.

1,632,682. SPEED-CONTROL SYSTEM; W. Seiz, Baden, Switzerland. App. filed Jan. 12, 1924. In which an induction motor is concatenated with a commutator exciting machine. Means for controlling the magnitude of the voltage injected into the secondary circuit of the motor by the commutator machine.

1,632,769. FILAMENT FOR INCANDESCENT LAMPS OR SIMILAR ARTICLES; C. Severin, Cleveland Heights, Ohio. App. filed Dec. 4, 1926. Coiled filament having a U or V shape.

Directory of Electrical Associations

Printed in the First Issue of Each Volume

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NORTHWEST ELECTRIC LIGHT AND POWER ASSOCIATION (Geographic Division N.E.L.A.). Secretary, C. W. Lundquist, Utah Power & light Co., Salt Lake City, Utah.

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Business Facts for Electrical Men

Selected Statistics Presented Graphically for the Use of All Interested in Analyzing the Trend of the Electrical Business

Turning the Wheels of Industry

IN THE early days the use of electrical energy was confined to lighting. The next twenty years saw a gradual introduction of the electric motor. By the beginning of the present century serious efforts were being made to acquire a power business for filling out the valleys in the load curve.

In 1902, when the industry was twenty years old, motor service provided somewhat over 12 per cent of the total revenue. Statistics for industrial energy consumption were not collected at that time; it has been estimated at 600,000,000 kw.-hr., in round numbers, or somewhere between a fourth and a third of the total energy generated. The rest was used chiefly for lighting.

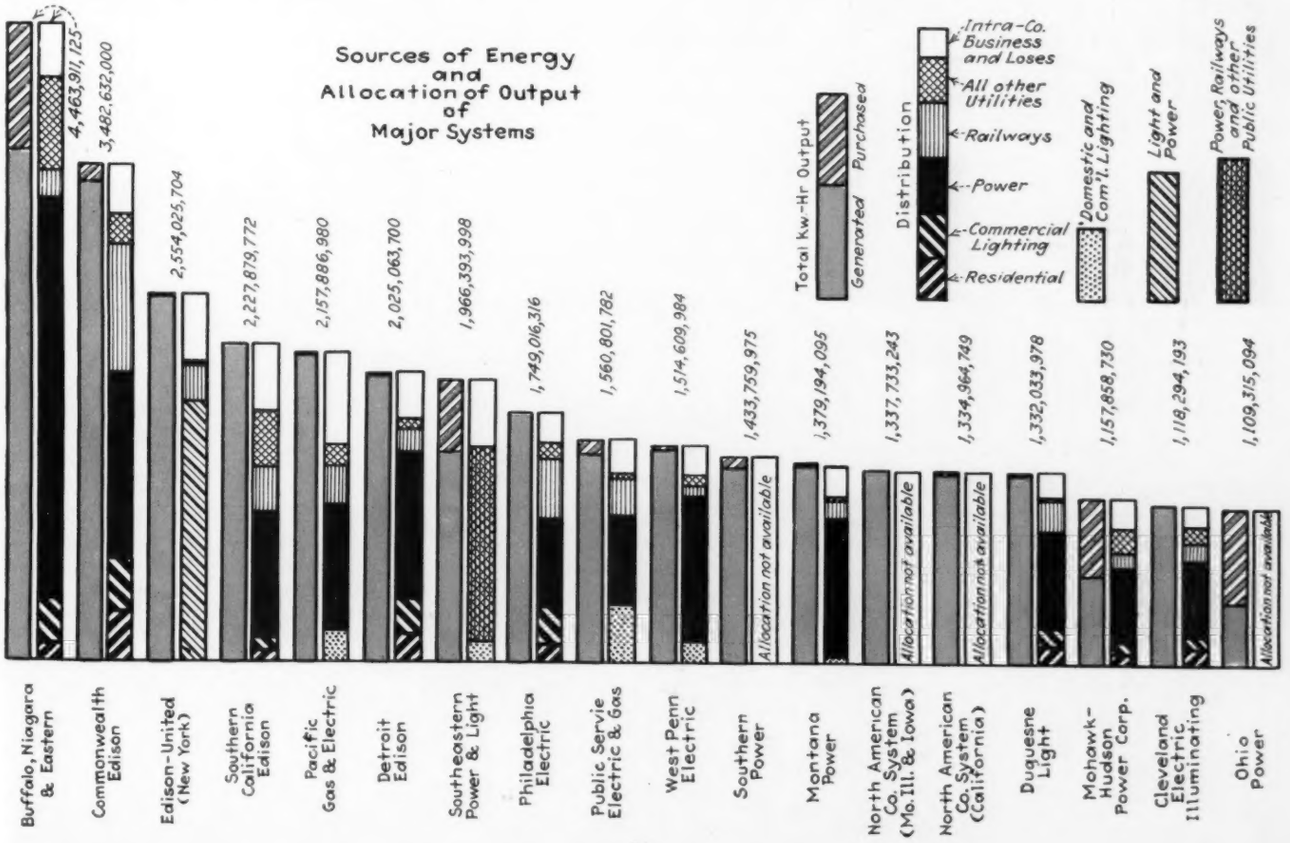
Today conditions are reversed. Of the combined power and lighting load, the former now constitutes roughly 70 and the latter 30 per cent; in addition, railway operation draws on central stations for the equivalent of ten times the industrial load of 1902, though taking only 10 per cent of the total energy now being generated annually.

One system in 1926 generated more than double the nation's total output in 1902. Two others exceeded the same record. The tabulation recently published by the ELECTRICAL WORLD of statistics for 126 major systems accounts for 84 per cent of the energy generated by central electric stations in the United States in 1926 and permits of a detailed analysis of their output. Most of them sell considerable blocks of energy to railways and to other utilities. Of the remainder, 12.3 per cent is sold for residential use, 16.1 for commercial lighting, and 71.6 per cent goes to power customers.

An analysis for each of the eighteen systems having an output of 1,000,000,000 kw.-hr. or more in 1926 is shown graphically in the accompanying chart. Their combined output is 43.5 per cent of the national total.

Most of these very large systems are quite self-contained and get little of their output from other than their own generating stations, although in one case 60 per cent of the output was purchased. Practically all supply much energy at wholesale, for transportation and for resale by other utility companies. No doubt a considerable portion of the latter represents interchanges or transfers, especially where the corresponding item of purchased energy also looms large. Lighting, both residential and commercial, consumes a surprisingly modest fraction of the output; energy employed by the companies for their own use, together with line and conversion losses, consumes from 8.4 to 25 per cent of the total, being in general smaller where the sales are made on the high-tension side to wholesale users, or where a compact urban service exists, than on systems having far-flung transmission circuits, covering a wide territory.

Most of the data for statistics in the ELECTRICAL WORLD are gathered by it from original sources. Privilege is freely given to readers of the ELECTRICAL WORLD to quote or use these statistics for any legitimate purpose. While there is no requirement that the source of data be given, yet it would help the ELECTRICAL WORLD in obtaining and compiling further basic information if those who make use of these statistics would give credit to the ELECTRICAL WORLD.



Southern Manufacturing 16 per Cent Over Last Year

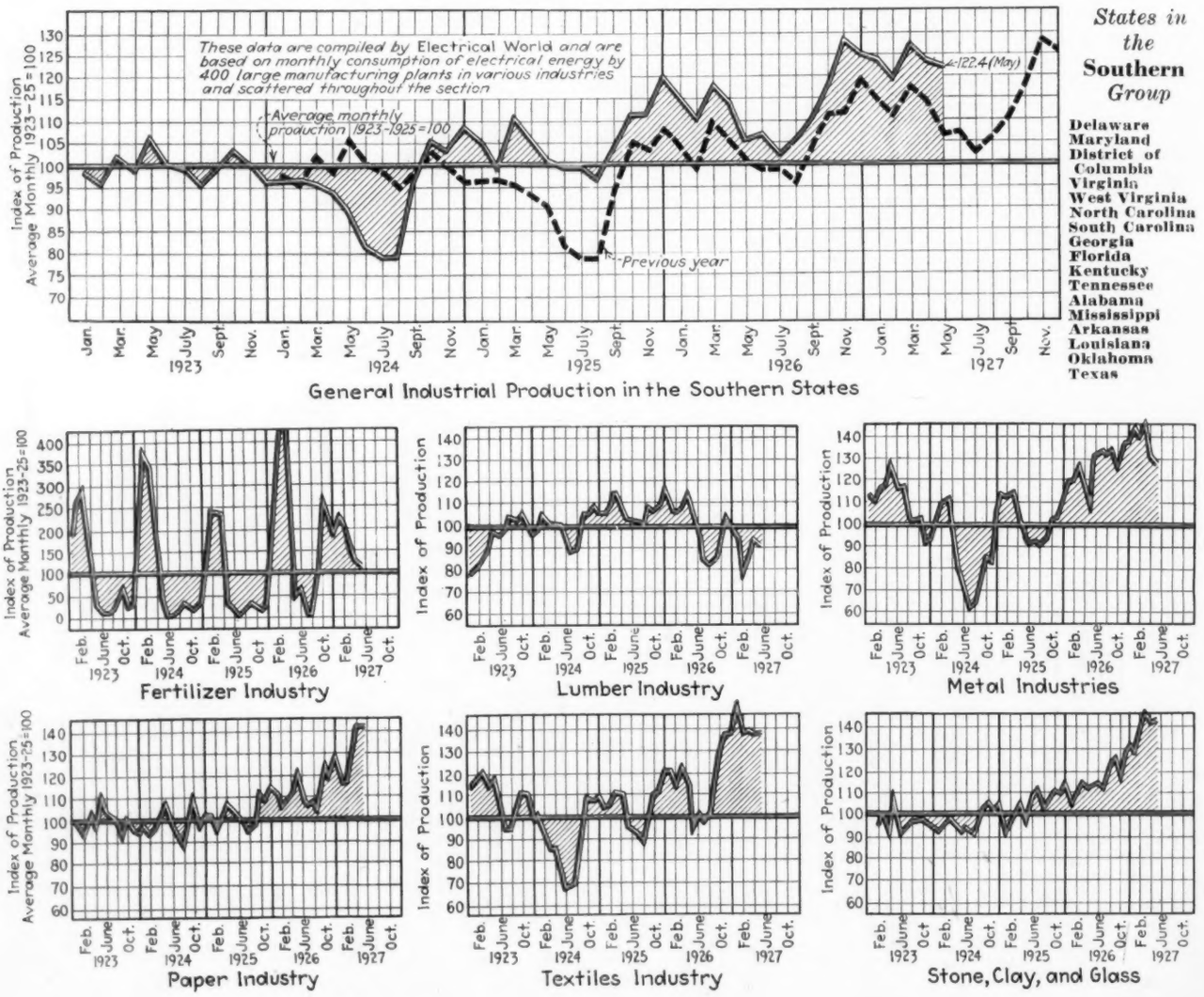
THAT most of the outstanding primary industries of the Southern States were operating at an unusually high rate of activity during the first five months of the year is indicated by reports received by the ELECTRICAL WORLD on the consumption of electrical energy by manufacturing plants operating in this section. May production was 0.4 per cent under that of April, but after corrections are made for the number of working days it is found that the productive activity during April and May was virtually at the same rate. Monthly production by the manufacturing plants of the Southern States has been consistently above that reported for the same months of the previous year ever since September, 1924. The May production was 16.0 per cent over May of last year.

That the industries of the Southern States will record new production figures during 1927 now seems unquestionable. In fact, many economists and students of industry are now saying that the remarkably high productivity of the manufacturing plants in the Southern States and in the country as a whole during the past eighteen months has not been abnormal but has even possibly been subnormal, when due consideration is given to the natural growth of production. This conclusion is especially applicable to the production activity which has been witnessed by the manufacturing plants of the Southern States during this period. This section of the country is witnessing an industrial development which is without parallel in any other section of the nation.

From Florida, where at Hollywood a 35-ft. harbor is nearing completion accommodating the largest of freighters, to Virginia on the north, and from the Atlantic to the western borders of Texas and Oklahoma, the development of manufacturing has been one of the chief interests in the minds of the people. Not only is the section becoming more and more self-supporting as to natural products, but the population is increasing rapidly through migration from the overcrowded North, this new population representing an increased market of no small proportions for manufactured goods.

Both of these basic tendencies must result in a material increase in the volume of products turned out by the manufacturing plants of the section. For these reasons an increase in production during May of 16 per cent over May of last year is not necessarily an indication of abnormal production by the manufacturing plants of the Southern States. There is every reason to expect an increase in the annual production by the manufacturing plants of this section of from 5 to 15 per cent over the previous year even in normal times. No section of the nation is better favored in the potential annual growth in the volume of manufactured products than is the group of states under discussion.

Operations in the textile plants of the Southern States during May were 1.2 per cent above those of April after corrections are made for number of working days. May operations, however, were about 49 per cent over those of May last year. The present production of the textile plants operating in the Southern States far exceeds any previous records established by this industry.

"Electrical World" Barometer of Industrial Activity in the Southern States

(Data Unadjusted for Seasonal Variation)